CIVIL ENGINEERING

NEW ORLEANS UNION PASSENGER TERMINAL PROJECT

see articles by Wallace and Blessey

ALL WELDED OVERPASS

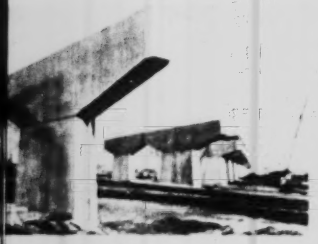
STATION PLATFORMS

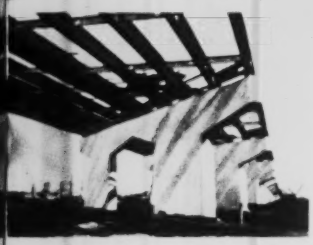
GENERAL CONTRACTOR
Slattery Contracting Corp.
New York, N. Y.

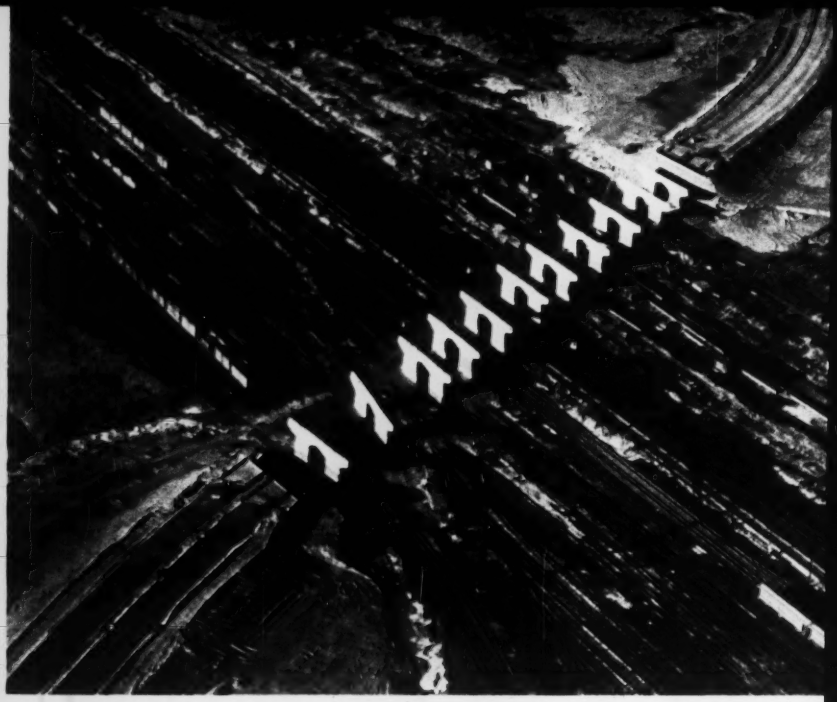
STEEL CONTRACTOR
American Bridge Co.
Ambridge, Pa.

ENGINEERS
Howard, Needles,
Tammen & Bergendoff
New York, N. Y.

ARCHITECTS
Alfred Fellheimer
Steward Wagner
New York, N. Y.







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THE NEW JERSEY TURNPIKE

RAYMOND IS PROUD to have played a vital part in the creation of this fabulous new cross-state highway. The railroad overpass near Ridgefield, N. J., is just one of several projects on the Turnpike that rest on Raymond Piles. 778 Raymond Pipe Step-Taper Piles driven for 11 piers and 2 abutments, with an average length of 120′ and a total footage of 93,283′ were used on this overpass—just another example of the part Raymond is playing in building tomorrow's world today.

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Beneath the surface of this undisturbed street in Washington, D. C. men are at work . . . reconditioning water pipelines with the Centriline process. Above ground, traffic flows smoothly . . . unobstructed by the usual men, machinery and excavations. Because the Centriline process centrifugally applies cement-mortar lining to pipes in place, excavation time, overall costs and interruption to street traffic are kept at an absolute minimum. Couple these advantages with the fact that Centrilining permanently prevents corrosion and tuberculation, increases carrying capacity, reduces pumping costs, gives new pipe service at a fraction of the cost of new pipes, and you have the reason why more and more city engineers and officials are specifying Centriline for their pipeline projects.

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GENERAL CONTRACTORS

NAME	
Abernathy, T. F.	Memphis, Tennessee
Ace Construction Company	Omaha, Nebraska
Acme Construction Company	Oklahoma City, Oklahoma
Anderson & Gregory	Nashville, Tennessee
Arbuckle Inc., John	Poughkeepsie, New York
Arnolton Company, W. H.	Dunedin, Florida
Armstrong Company, J. D.	Ames, Iowa*
Asile Brothers	Meriden, Connecticut
Asphalt Paving Company	Jacksonville, Florida
Atkinson, Guy F.	San Francisco, California
Atlas Construction	New York City, New York
Bair & Company, Roy J.	Spokane, Washington
Bean Construction Co.	Stratton, Connecticut
Bent and Bartlett	Cincinnati, Ohio
Bianchi and Co., Inc., C.	Framingham, Massachusetts
Bias Road Construction Company	Pine Bluff, Arkansas
Bloomer & Son, John S.	Appleton, Wisconsin
Blythe Bros. Company	Charlotte, North Carolina
Boston Construction Company	Lynwood, Iowa
Brewster & Son, Inc., C. M.	Bogota, New Jersey
Brown Brothers	Memphis, Texas
Brown Construction Company	Pueblo, Colorado
Brown Const. Co., L.	Glendora, California
Brown and Root, Inc.	Houston, Texas
Buchhill & Sons, M. P.	Arlington, Virginia
Campagnetta & Lazzi	Millerton, Rhode Island
Campbell & Tolfree	Fargo, North Dakota
Chessher, Ben	Keystone, Texas
Clarksville, J. B.	Pittsfield, Maine
Clarkson Const. Company	Kansas City, Missouri
Collins and Sons, W.	Fargo, North Dakota
Construction Aggregate	Newark, New Jersey
Corbett & Johnson	San Diego, California
Cowles Const. Co., F. E.	Lansdale, City, Indiana
Crafenbach, W.	Wainscott, Minnesota
Crane Construction Corp.	Mineville, Long Island, N. Y.
Dickinson & M.	So. Charleston, West Virginia
Dietz Drainage & Const. Co.	Greenville, Mississippi
Dressler Construction Co.	Garden City Park, L. I., N. Y.
Dunbar Construction Co.	Redwood City, California
DuShong, Leno	Plant City, Florida
Dyson Brothers	Grand Island, Nebraska
Dickerson & Associates Co.	Savannah, Georgia
Exeter Construction Co.	Marion, Kentucky
Excavating Machinery Co.	Cumberland, Iowa
Excavating Equipment Company	Jamaica, L. I., New York
Feiner Construction Co.	Cincinnati, Ohio
Fisher Contracting Co.	Phoenix, Arizona
Foley Brothers	St. Paul, Minnesota
Foss & S Contracting Co.	Butte, Montana
Fuller Steves	Newport, Kentucky
Fundenburg Const. Company	Arlington, Washington
General Construction Co.	Seattle, Washington
Gibbons & Reed Const. Co.	Salt Lake City, Utah
Gilbane Building Co., Inc.	Providence, Rhode Island
Gilbert Engineering Co.	Statesville, North Carolina
Gilliland, William	Alpena, Michigan
Grissom, John and Paul	Grand Rapids, Michigan
Groff Construction Co.	Lancaster, Pennsylvania
Grosse Construction Co.	Watsonville, California
Gray, Inc., Lewis	Dewitt, New York
Green Construction Company	Oakland, Indiana
Griffin, W. E.	Bayley, Minnesota
Griffith Company	Los Angeles, California
Guettinger Const. Company	Spokane, Washington
Gulf Contracting Co.	Memphis, Tennessee
Hahne E. &	Corsicana, Texas
Hall, Fred	Valley Mills, Texas
Halvorson Construction Co., C. M.	Portland, Oregon
Halvorson Const. Co., H.	Spokane, Washington
Hanson, Walter	Richardton, North Dakota
Harlan Construction Co.	Republican City, Nebraska

GENERAL CONTRACTORS

NAME	
Hawthorne, Robert	Philadelphia, Pennsylvania
Henderson Brothers	Valley Stream, L. I., N. Y.
Hartford Construction Co.	Hartford, North Carolina
Hicks, Harry D.	San Gabriel, California
Hite, Henderson	Bardstown, Kentucky
Hjelmstad and Wandre	Blooming Prairie, Minnesota
Hockman and Son, W.	Fairmont, Minnesota
Hodgkiss and Thompson	Detroit, Michigan
Hubner, E. J.	Denver, Colorado
Huling Constr. Co., Charles	Great Bend, Kansas
Hunt Constr. Co., Arlon	East Omaha, Nebraska
Hunter Construction Co.	Ada, Oklahoma
Inter City Sand & Gravel Co.	Eugene, Oregon
James Constr. Co., Guy	Oklahoma City, Oklahoma
Jarrell, E. L.	Anniston, Alabama
Jeffers, Inc., F. R.	Toledo, Ohio
Jurgensen, John	Newton, Ohio
Kamano and Nishida	Hilo, Territory of Hawaii
Keeley Construction Company	Clarksburg, West Virginia
Klaus Construction Company	Appleton, Wisconsin
Klaus Company, Samuel	St. Louis, Missouri
Kuckendall, Crockett	Cotulla, Texas
Kuckendall, J. A.	Cotulla, Texas
Langenfelder & Son, Inc., C. J.	Baltimore, Maryland
Langer, Robert	Riverside, Texas
Latin American Engg. Service	San Antonio, Texas
Lee Lincoln Contractors	Nixon, Montana
Livelo & Lindsey	Durango, Colorado
Logan & Sons, W. E.	Muskogee, Oklahoma
MacDougall Constr. Company	Atlanta, Georgia
Mackie Const. Co., Arthur	Baltimore, Maryland
Madison Const. Company	Edwardsville, Illinois
Mahoney, J. T.	St. Louis, Missouri
Mangum, C. C.	Raleigh, North Carolina
Mauer and Otto	Sac City, Iowa
McCarthy Pipe Constr. Co.	Nevada, Missouri
McClearman, George	Evansville, Louisiana
McDonald and Kruse	Los Angeles, California
McGraw Construction Company	Middletown, Ohio
McGraw & Company, F. H.	Paducah, Kentucky
McHarg, Foster	Riverside, California
McKee Construction Company	Sinton, Texas
McKee Construction Company	Jackson, Alabama
Metcalfe Hamilton Company	New York City, New York
Milne Excavating Company	Omaha, Nebraska
Mills Construction Company	Omaha, Nebraska
Mills Company, Ralph E.	Salem, Virginia
Mittry Construction	Los Angeles, California
Moorman & Son, J. W.	Muskogee, Oklahoma
Morrison-Knudsen Const. Co.	Boise, Idaho
Morrissey, Inc., James D.	Philadelphia, Pennsylvania
Moss Thornton Co., Inc.	Lewis, Alabama
Muehlenbeck, Wm. F.	Saginaw, Michigan
Mulligan Brothers	Greenville, Kentucky
Nelson Brothers	San Diego, California
North Atlantic Constructors	New York City, New York
Oahu Construction Company	Honolulu, Territory of Hawaii
Oliver, Reginald	Calburn, Idaho
Olson & Sons, G. A.	Marshall, Minnesota
Osburn & Co., Inc., H. T.	Franklin, Pennsylvania
Palmieri Construction Co.	Monongahela, Pennsylvania
Perry Construction Company	Scranton, Pennsylvania
Petullo, Inc., Edward	Yonkers, New York
Pioneer Constructors	Tucson, Arizona
Pohl Constr. Co., Inc. L.	St. Louis, Missouri
Pool Construction Company	Shawnee, Oklahoma
Porter Dewitt Constr. Co.	Poplar Bluff, Missouri
Price Osborne Osborne & Nelson	Lynchburg, Tennessee
Pullen and Owens	Nashville, Tennessee
Ramon and W. Ramis	Pearsall, Texas
Rapone Contracting Company	Hicksville, L. I., New York
Rayn & Sons, F. W.	Janesville, Wisconsin

GENERAL CONTRACTORS

NAME	
Reetzoff & Kezoth	Bakersfield, California
Rider, Otrell	Tyme, Arizona
Ruby Construction Company	Madisonville, Kentucky
Ruth Construction Company	Scottdale, Pennsylvania
Rutherford Corporation	Oakland, California
Ryan Construction Company	Evansville, Indiana
Salvucci, Peter	Waltham, Massachusetts
Serafin Constr. Co., Inc.	Binghamton, New York
Sexton Constr. Co., A. E.	East Hartford, Connecticut
Schnell, Ralph D.	Del Norte, Colorado
Schlesinger and Patterson	Chandler, Arizona
Schulz Contracting Co., John	Garden City Park, L. I., N. Y.
Scott, Inc., W. H.	Franklin, Virginia
Shattuck & Purnell	Casper, Wyoming
Silver State Constr. Co.	Fallon, Nevada
S & M Construction Co., Inc.	Providence, Rhode Island
Smalley, O. W.	Sabina, Ohio
Smith Construction Company	Feltham, New York
Smith, Gibb, and Smith	Muskogee, Oklahoma
Snare Corporation, Frederick	New York City, New York
Soto Constr. Company, Jos.	San Jose, California
Steers, Glover	New York City, New York
Stenkamp, Inc., E.	Los Angeles, California
Stewart, Howard	Brooksville, Indiana
Stone City Constr. Company	Hartford, Indiana
Stone Construction Company	Dallas, Texas
Stowell, R. B.	Washington, D. C.
Stuart, J. D. and C. M.	Blanco, Texas
Suettenfarm, James	Missoula, Montana
Tangino Construction Company	Durham, North Carolina
Teer Company, Nello L.	Sacramento, California
Teichert & Son, Inc.	Hilo, Territory of Hawaii
Tenaka, J. M.	Dallas, Texas
Texas Construction Company	Paris, Texas
Thompson, C.	Fayetta, Colorado
Thornburg, Vance	Darrow, Louisiana
Tomlinson, T. R.	Owensta, New York
Turrington Construction Co.	Homestead, Florida
Tower Contracting Co., Dave	Martin City, Montana
Trisdale, Inc., J. H.	Cincinnati, Ohio
Turpin & Stewart	Beckley, West Virginia
Vecellio and Grogan	Trenton, Nebraska
Vinnell United Beil Company	Lubbock, Texas
Wastes, Lake	Auburn, Texas
Wentmount, John	Bucks Island, North Carolina
Wester Construction Co.	Plainville, Connecticut
White Oak Excavators	Syracuse, New York
Wiseman Co., Inc., D. W.	Columbus, Georgia
Wright Contracting Company	Texco, Texas
Wright, John D.	Weston, Massachusetts
Wynne & Company, Inc., Gil	Hewlett, L. I., New York
Zara Contracting Company	

MINING

NAME	
Allen Brothers	Silver Springs, Tennessee
A. & M. Coal Co.	Shinnston, West Virginia
A. & P. Mining Co.	Enterprise, West Virginia
Bittner Fuel Co.	Jane Lew, West Virginia
Blair & Oldham Construction Co.	Pineville, Virginia
B. & M. Coal Co.	Meadville, Pennsylvania
Boiling Construction Co.	Pound, Virginia
Bortz & Bortz Coal Co.	Stoneboro, Pennsylvania
Bowling, Tyler	Bluefield, West Virginia
Brown, Earl M.	Clearfield, Pennsylvania
Calvert & Youngblood	Traffard, Alabama
Casella Coal Co.	Buchanannon, West Virginia
Cleghorn, J. E.	Clarksburg, West Virginia
Cleveland Cliffs Mining	Nashawa, Minnesota
Coal Strippers, Inc.	Weirton, West Virginia
Compass Coal Co.	Philippi, West Virginia
Consolidated Coal Co.	Jenkins, Kentucky

FLEET OF BIG RED INTERNATIONAL TD-24s

MINING

NAME	
Coronet Phosphate Co.	Plant City, Florida
C. & P. Coal Co.	Fairmont, West Virginia
Daugherty Coal Co.	Terra Alta, West Virginia
Deanville Coal Co.	Weston, West Virginia
Drummond Coal Co., H. E.	Jasper, Alabama
Ford & Gash II	Greensboro, Pennsylvania
Gallaway Coal Mining Co.	Carbon Hill, Alabama
Georgia Kaolin Co.	Atlanta, Georgia
Grease Ridge Coal Co.	Ironton, Ohio
Hanna Coal Co.	Adena, Ohio
Hanna Co., M. A.	Hibbing, Minnesota
Hazelwood, George F.	Cumberland, Maryland
Imperial Coal and Construction Co.	Rupert, West Virginia
Kelly Coal Co.	Beelick Knob, West Virginia
Lies and Son, H. B.	Winona, West Virginia
Mays Coal Co.	Clarion, Pennsylvania
McCarrell & Grimes	Sanders, Arizona
McComas, Berkley	Scottown, Ohio
Michigan Limestone & Chemical Co.	Rogers City, Michigan
Mottern, Harry	Liberty, Pennsylvania
Nashville Coal Co.	Nashville, Tennessee
New Shawmut Mining Co.	Weedsville, Pennsylvania
Ohio River Colliery	Columbus, Ohio
Oliver Iron Mining Co.	Coleraine, Hibbing & Va., Minn.
Pendergrass, Zeb	Ramelle, West Virginia
Phelps Dodge Corp.	Douglas, Arizona
Pickands Mather Co.	Hibbing, Minnesota
Putman & Greene	Osceola Mills, Pennsylvania
Quinn, Ted	Sleshing Run, Pennsylvania
Rardin Bros.	Akron, Ohio
R. & V. Contracting Co.	Clarksburg, West Virginia
Sanbrae Coal Co.	Pittsburgh, Pennsylvania
S. B. & S. Co.	Pottsville, Pennsylvania
Scott Coal Co.	Clarksburg, West Virginia
Shafer, Robert	Philippi, West Virginia
Sherman, Joe	Hawthorn, Pennsylvania
Snyder Brothers	Cowansville, Pennsylvania
Stripping Contractors	Clearfield, Pennsylvania
Trading Bros., Inc.	Mt. Hope, West Virginia
Truax Traer Coal Co.	Pinckneyville, Illinois
Un-Seth Coal Mines	Healy River, Alaska
Wabash Ridge Corp.	Kassellas, Pennsylvania
Walls & Sons Coal Co., Charles	Oliver Springs, Tennessee
Whitaker Coal Co., H. B.	Norton, Virginia
Yates Coal Co.	Ashland, Kentucky

LOGGING

NAME	
Abaco Lumber Co.	Nassau County, Bahamas
Anderson, Mel	Weaverville, California
Arch Cape Logging Co.	Tillamook, Oregon
Arrow Mills	Eureka, California
Bohemia Lumber Co.	Cottage Grove, Oregon
Brown and Bert Timber Co.	Bodega Bay, California
Brown Tie and Lumber Co.	McCall, Idaho
Buck Mountain Logging Co.	Shelton, Washington
Cal-Ida Lumber Co.	Downieville, California
Castle Lumber Co.	Myrtle Point, Oregon

LOGGING

NAME	
Clackamas Logging Co.	Portland, Oregon
Coastal Plywood Co.	Cloverdale, California
Denny Logging Co.	Willamina, Oregon
DeVilbiss, C. Dudley	Ukiah, California
Fisch Logging Co.	Arcata, California
Flathead Lumber Co.	Thompson Falls, Montana
Ford, Donald A.	Ukiah, California
Freesch Oil Co.	Bonners Ferry, Idaho
Gooch Logging Co.	Lyons, Oregon
Hammond Lumber Co.	Trinidad, California
Hines Lumber Co.	Westfir, Oregon
Laidlaw Timber Co.	Orick, California
Long Bell Lumber Co.	Vaughn, Oregon
Marenakos Logging Co.	Renton, Washington
Matheney, S. F.	Sublimity, Oregon
McCallie Logging Co., B. L.	Eugene, Oregon
McCallie Bros. Logging Co.	Lebanon, Oregon
McNutt Bros. Construction Co.	Eugene, Oregon
Michigan California Lumber Co.	Camino, Calif.
Mortensen, Inc., Lee	Roseburg, Oregon
Neals Lumber Co., J.	Libby, Montana
N S P Logging Co.	Coquille, Oregon
Opperman, Ralph	Qualala, California
Paul Bunyan Lumber Co.	Susanville, California
Portland Creek Logging Co.	Oakland, Oregon
Potlatch Forests, Inc.	Lewiston, Idaho
Rasor Logging Co.	Eugene, Oregon
Ravenner, Inc.	Sapho, Washington
Russell & Sons, V. R.	Valsetz, Oregon
Russell & Gillette	Cle Elum, Washington
Schuler Construction Co., J. F.	Robbinsville, North Carolina
Siuslaw Forest Products Co.	Mapleton, Oregon
Smith Lumber Co., Ralph L.	Anderson, California
Smith, Ralph	Tillamook, Oregon
Snoqualmie Falls Lumber Co.	Snoqualmie Falls, Washington
Stoddard, Roy	Fort Bragg, California
Sweet Brothers Lumber Co.	Eugene, Oregon
Ulrich, William	Spokane, Washington
Union Lumber Co.	Fort Bragg, California
Vosburg & White	Alsea, Oregon
Westside Lumber Co.	Tuolumne, California
Weyerhaeuser Timber Co.	Tacoma, Washington
White River Lumber Co.	Enumclaw, Washington
Willamette Valley Lumber Co.	Dallas, Oregon
Woolley, Harold	Drain, Oregon

PIPELINE

NAME	
Anderson Brothers	Houston, Texas
Anderson Construction Co.	Salem, Illinois
Associated Pipe Line Corp.	Houston, Texas
Bechtel Corp.	San Francisco, California
Bishop and Lock	Dallas, Texas
Britton Contracting Co.	Washington, Pennsylvania
Burden Construction Co., O. R.	Wichita Falls, Texas

PIPELINE

NAME	
Fulton, R. H.	Lubbock, Texas
El Paso Natural Gas Co.	El Paso, Texas
Gentry Construction Co., M. L.	Jackson, Mich.
Mahoney Contractors	Lansing, Michigan
Midwestern Constructors	Tulsa, Oklahoma
Morrison Construction Co.	Austin, Texas
Oklahoma Construction Co.	Dallas, Texas
Price Company, H. C.	Bartlesville, Okla.
Saugh Company, N. A.	Campbellsville, Kentucky
Smith Contracting Co.	Ft. Worth, Texas
Smith Contractor Corp.	Altavista, Virginia
Texas Louisiana M. R.	Ft. Worth, Texas

MISCELLANEOUS

NAME	
Alaska Road Commission	Alaska
Baltimore, City of	Baltimore, Maryland
Bethlehem Steel Co.	Bethlehem & Steelton, Pa.
Commonwealth Edison Co.	Chicago, Illinois
Consumers Power Co.	Jackson, Michigan
Dane County Highway Dept.	Madison, Wisconsin
DuPont, E. I. deNemours & Co., Inc.	Wilmington, Delaware
Duquesne Light Co.	Pittsburgh, Pennsylvania
Kehaha Sugar Co., Ltd.	Kehaha, Kauai, T. H.
Lone Star Steel Co.	Lone Star, Texas
Niagara Mohawk Power Corp.	Albany, New York
Northern Indiana Public Service Co.	Gary, Indiana
Public Service Co., No. Illinois	Chicago, Illinois
Sheboygan County Highway Dept.	Sheboygan, Wisconsin
Tennessee Coal and Iron Co.	Fairfield, Alabama
Tennessee Valley Authority	Knoxville & Chattanooga, Tennessee
U. S. Atomic Energy Commission	Oak Ridge, Tennessee
U. S. Engineers	Tulsa, Oklahoma
W. Virginia State Road Commission	Charleston, West Virginia

CANADIAN CONTRACTORS

NAME	
Iron Ore Company of Canada, Ltd.	Montreal
Bell Asbestos Corp.	Asbestos, Quebec
Fraser Brace Ltd.	Montreal
Shawinigan Power, Ltd.	Montreal
McFarland Construction Co., Ltd.	Petton, Ontario
Ontario Hydro Electric Commission	Toronto
Peel Construction Ltd.	Brampton, Ontario
Carter Construction Ltd.	Toronto, Ontario
Wasson Coal Stripping	Minto, N. B.
Sten Peterson	Winnipeg, Manitoba
Bird Construction Ltd.	Regina, Saskatchewan
Morrison Knudson, Canada) Ltd.	Vancouver, B. C.
Alaska Pine Ltd.	Vancouver, B. C.
Steeprock Iron Mines Ltd.	Steeprock, Ontario
Aluminum Co. of Canada	Montreal, Quebec
Celanese Corp. Ltd., of Canada	

The list of TD-24 fleet owners is growing every day, as is the vastly longer list of owners of single TD-24 tractors. For this reason the above list is not complete. If you're a TD-24 fleet owner whose name is missing, we'll catch you next time.

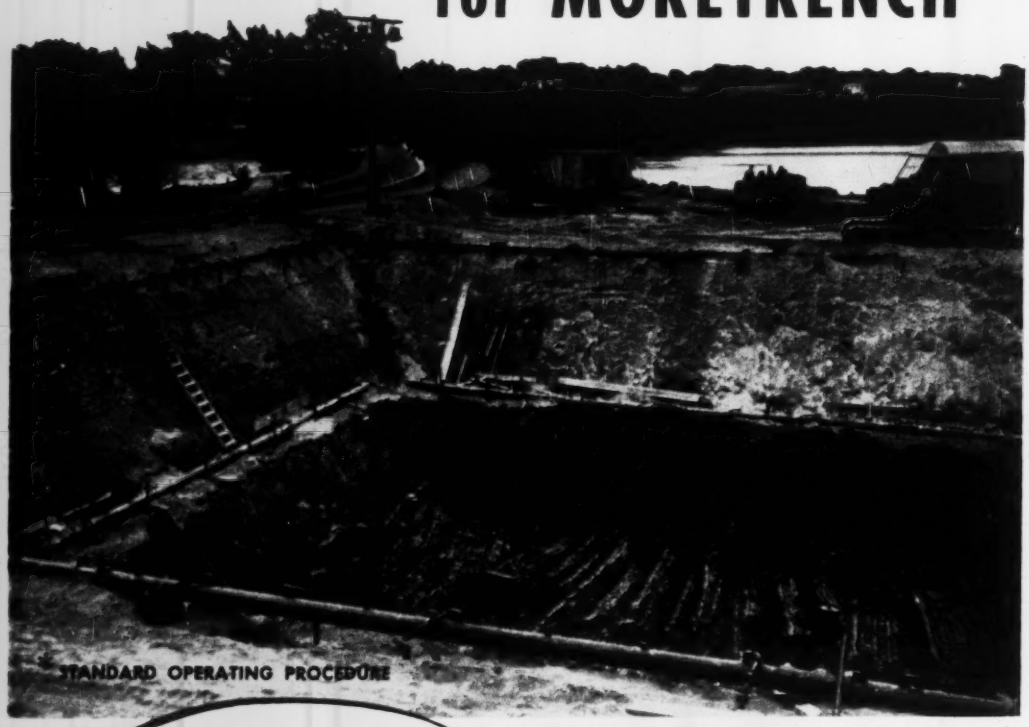
INTERNATIONAL HARVESTER COMPANY
CHICAGO 1, ILLINOIS

INTERNATIONAL HARVESTER

INTERNATIONAL

POWER THAT PAYS

Dewatering fine soils is S. O. P.* for MORETRENCH



CONTRACTOR: "Are you sure your wellpoints will work in such fine soil?"

MORETRENCH: "We guarantee it!"

This is the Watchemoket Pumping Station in East Providence, R.I. Twenty-two feet of water in extremely fine sand and clay presented a pumping problem . . .

On May 31st pumping started at 2 P.M. On June 1st, C. L. Guild Construction Co., Inc., E. Providence, was excavating "in the dry."

The Moretrench combination of expert planning, careful installation, and superior equipment gets results every time.

To guarantee your profit on a wet job, pump with Moretrench!

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RECLAIM WORN-OUT *Surface Material on* BITUMINOUS ROADS *with* HYSTER® Grid Roller

On this black top salvage job in California, Hyster Grid Roller and Caterpillar Motor Grader did in 10 HOURS what it would have taken 7 or 8 DAYS to do with old methods.

Saves 5 Ways

✓ **TIME** — The Grid Roller pulverizes old surface material, compacts road base and new surface courses faster and better than old-style methods and equipment.

✓ **MATERIAL** — On normal salvage, the Grid Roller provides sufficient mix from old material for laying down new surface.

✓ **BINDER** — Usable binder in salvaged material is exposed, thus often reducing new oil required from ¾ to ⅜ gal. per sq. yd.

✓ **EQUIPMENT** — The Grid Roller does triple duty — reclaims old mat, compacts base, rolls new surface courses.

✓ **LABOR** — One operator performs simultaneously the pulverizing and scarifying or blading operations. Faster road reclaiming also means less labor time on the job.

BITUMINOUS ROAD SALVAGE has been revolutionized by the Hyster Grid Roller. Now it is **economically possible** to salvage, rejuvenate and use the old, worn-out surface material for re-laying the new road surface.

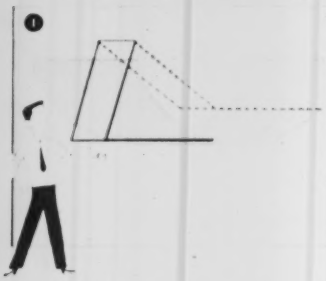
The procedure: (1) SCARIFY or rip up the worn surface; (2) PULVERIZE—Grid Roller reduces chunks to original loose road mix; (3) PREPARE BASE — compact with the Grid Roller; (4) LAY DOWN new surface, using salvaged road mix material, and rolling out with Grid Roller; (5) TURN OVER TO TRAFFIC.

From coast to coast CITY, COUNTY, STATE, FEDERAL and PRIVATE ROADS are being reclaimed at great savings in time, oil, material, labor and equipment. The nature of the job determines whether the Grid Roller should be towed by a motor grader or tractor.

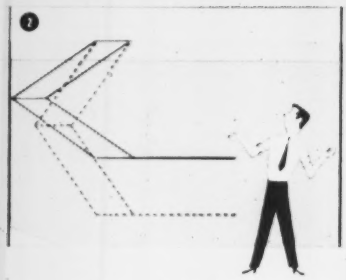
See your Caterpillar-Hyster dealer. Write for literature.

HYSTER COMPANY

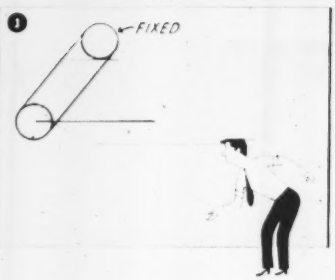
2999 N. E. CLACKAMAS ST., PORTLAND 8, OREGON
1899 NORTH ADAMS STREET, PEORIA 1, ILLINOIS



Start with a parallelogram somewhat like this. Visualize one of its short sides anchored to the top of a drawing board parallel to your base line, and let the remaining three sides be free to move together. Add a projecting straightedge to the bottom side as shown, and it will theoretically stay parallel to the base line. Parallel lines could be drawn anywhere within the shaded area above. But clearly, that field of action is too limited.



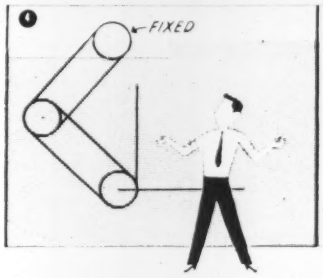
To obtain parallel motion over the entire working surface of the board, a second parallelogram could be coupled to the bottom of the first so that both have one short side in common. An elementary drafting machine would result . . . at least in principle. In practice, it would fall short because the slightest play at any of its 8 joints would create gross error at the straightedge.

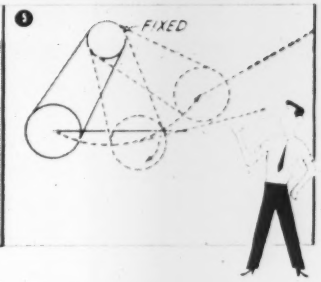


What is needed is a better mechanical design based on the same parallelogram principle. Take a pair of rotating drums, connect them with a tight steel band, and the assembly will behave like a parallelogram if the drum diameters are equal. Now couple a second band-and-drum assembly to the first in such a way that they have the middle drum in common . . . and you have the basis of a modern drafting machine.

and find out WHY— BETTER!"

The Right Angle





The band-and-drum machine, with all three drums of precisely equal diameters and with bands which will not slip, will draw absolutely parallel lines over the entire working area. But if the drum diameters are not equal, the parallelogram principle is violated and the machine cannot draw parallel lines. The greater the difference in diameter the more the lines will be out of parallel.

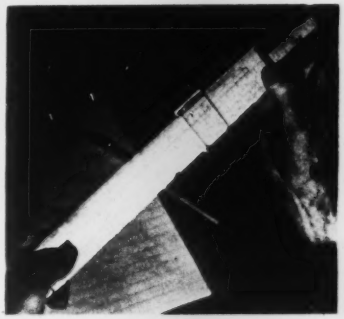
Here, in exaggerated form, is what happens when two of the drums are not equal in diameter. This could occur in either arm of the machine, conceivably in both arms with the errors being additive. From this it is clear that a central factor in the accuracy of a drafting machine is the accuracy of all drum diameters. That is why K&E goes to very extraordinary lengths in this regard in building PARAGON Drafting Machines.

These basic principles and the advanced engineering design in the PARAGON combine to give you the finest in drafting machines. You realize this as soon as you place your hand on the controls.

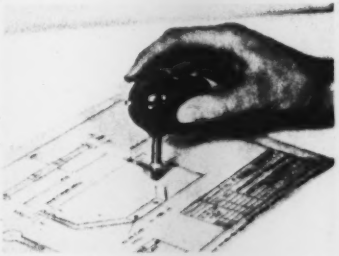
The scales rotate freely with the lightest pressure on the protractor control ring. Release it and they are locked at the nearest 15° position. Intermediate angles are easily set.

Another PARAGON feature is the open center construction of the arms. Even when they are twisted by lifting the head of the instrument off the board, it is impossible to disturb the factory-set band tension.

Ask your K&E Distributor or Branch to tell you about other PARAGON features or give you an actual demonstration.



An engineer without a K&E Slide Rule is like a doctor without a stethoscope. It's the badge of the profession . . . with good reason. The first American-made slide rule was a K&E, and generations have known these rules for their precision, readability and velvet-smooth operation. They come in all types.



After you've once used a K&E MOTORASER,† you'd no more go back to hand erasing than you'd take to drawing with your gloves on. With MOTORASER you can either pin-point your objective, or cover a larger area without damage to the drawing surface. Runs on 110 volt 60 cycle AC, or DC with an inexpensive adapter.

†TRADE MARK

K+E

PARTNERS IN CREATING

KEUFFEL & ESSER CO.

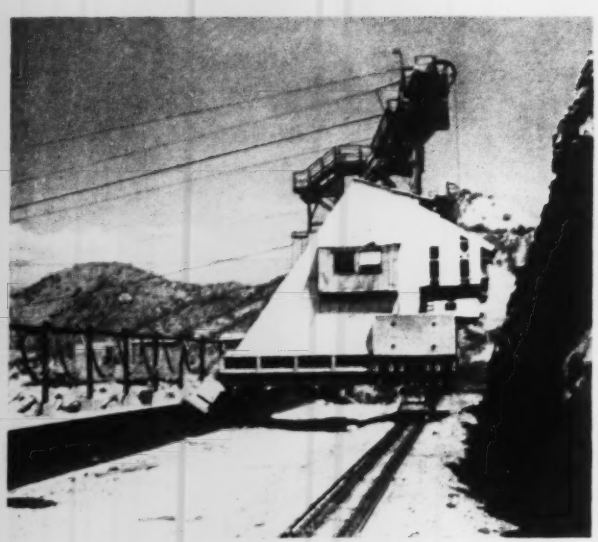
EST. 1867

Drafting, Reproduction, Surveying Equipment and Materials, Slide Rules, Measuring Tapes

NEW YORK • HOBOKEN, N. J.

CHICAGO • ST. LOUIS • DETROIT

SAN FRANCISCO • LOS ANGELES • MONTREAL



Cableway head tower, and tail tower across the canyon, are both driven on straight parallel tracks by G-E drives. Another set of towers for the service rig operates on the same tracks. Main cableway was built by Willamette Iron and Steel Co.

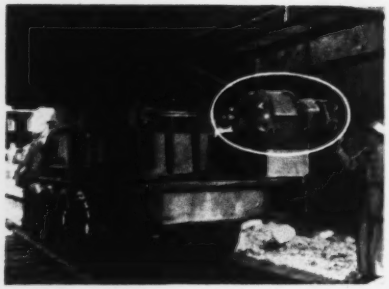
Cableway towers kept in line . . . electrically!

At Pine Flat Dam, G-E drives for movable head and tail towers prevent skewing, help keep pouring operations continuous!

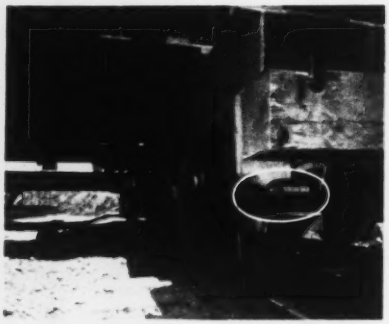
Here's an example of the versatility of electricity on construction jobs—a co-ordinated electric-drive system that helps keep an important project ahead of schedule. It's at Pine Flat Dam on Kings River in California, where a modern, high-speed G-E powered cableway—together with another rig for service functions—has set a pouring record of 4000 yards in one day.

All motors and control for the main cableway tower-drives on this Corps of Engineers dam, being built by Pine Flat Contractors Associated Companies, have been supplied by General Electric. In addition, the electric devices to keep the two cableways on the track, safely apart, and correctly aligned across the 2420-foot canyon, were all co-ordinated for the job by G-E application engineers.

This kind of engineering help—in application, installation, and service—regularly supplements G-E drives and power distribution systems, helps *you* get the most from *your* electrified construction equipment. *General Electric Co., Schenectady 5, N. Y.*



Under the head tower, this G-E 75-hp wound-rotor induction motor is one of two that drive the tower. Motors for head and tail towers are controlled by a single master switch in the operator's station.



Tower alignment is maintained automatically. This selsyn generator, connected to a head-tower wheel, and another on the tail tower, feed signals to a differential selsyn which controls speed of the tower-drive motors.

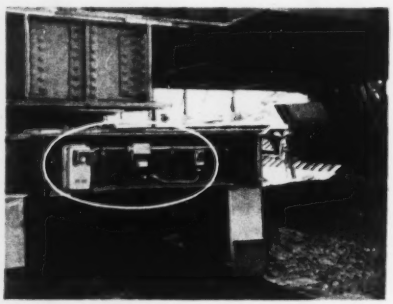


Photo-electric relays on each head tower automatically prevent the two rigs from colliding, and G-E limit switches keep towers from hitting stops at ends of the track. Thus operator can concentrate on spotting buckets.

Ask him today! **Whether you buy or build construction equipment, your G-E representative can show you how to do a better job—at lower cost—by complete electrification. Write him now, and he'll call on you at your convenience.**

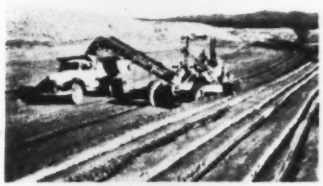
GENERAL ELECTRIC

660-21

Nature gets a lesson in topography on the Folsom Dam

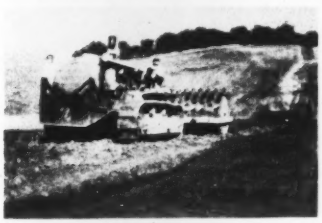
WHEN plans for damming the American River in California were considered, it became evident that the logical site near Folsom would not be adequate for potential storage if plugged the conventional way. Studying the problem, Army Engineers soon came up with an answer. They proposed a larger dam than the natural topography permits by adding wings to the main dam, plugging saddles between the hills and placing an auxiliary dam through an ancient river channel. The project will serve three purposes—flood control, water conservation and hydroelectric power for California. Gross length of the two dams and saddle dikes of rolled earth totals over 23,000 feet—more than four miles.

FOLSOM DAM AND RESERVOIR
AMERICAN RIVER
DRAINAGE AREA 1875 SQ MILES
GROSS CAPACITY 1000 000 ACRE FEET
GROSS POOL ELEVATION 418 665 FEET
RESERVOIR AREA 11500 ACRES
DAM AND AUXILIARY DYKES
GROSS LENGTH 23000 FEET
MAX HEIGHT 340 FEET
NORMON ISLAND AUXILIARY DAM
UNDER CONSTRUCTION BY
CORPS OF ENGINEERS
U.S. ARMY
SACRAMENTO DISTRICT
A MULTIPLE PURPOSE DAM TO SERVE CALIFORNIA BY CONSERVING WATER, BY CONTROLLING FLOODS AND BY THE PRODUCTION OF POWER. TYPE OF CONSTRUCTION FEATURES A CONCRETE RIVER SECTION WITH EARTH FILL WING DAMS AND DIKES
YOU ARE STANDING HERE
FUTURE POWER HOUSE
MAIN DAM



Above: Loading fill on the double on this 23,000-foot gross length project is this "Caterpillar" team a No. 12 Motor Grader equipped with DoMor Elevating attachment.

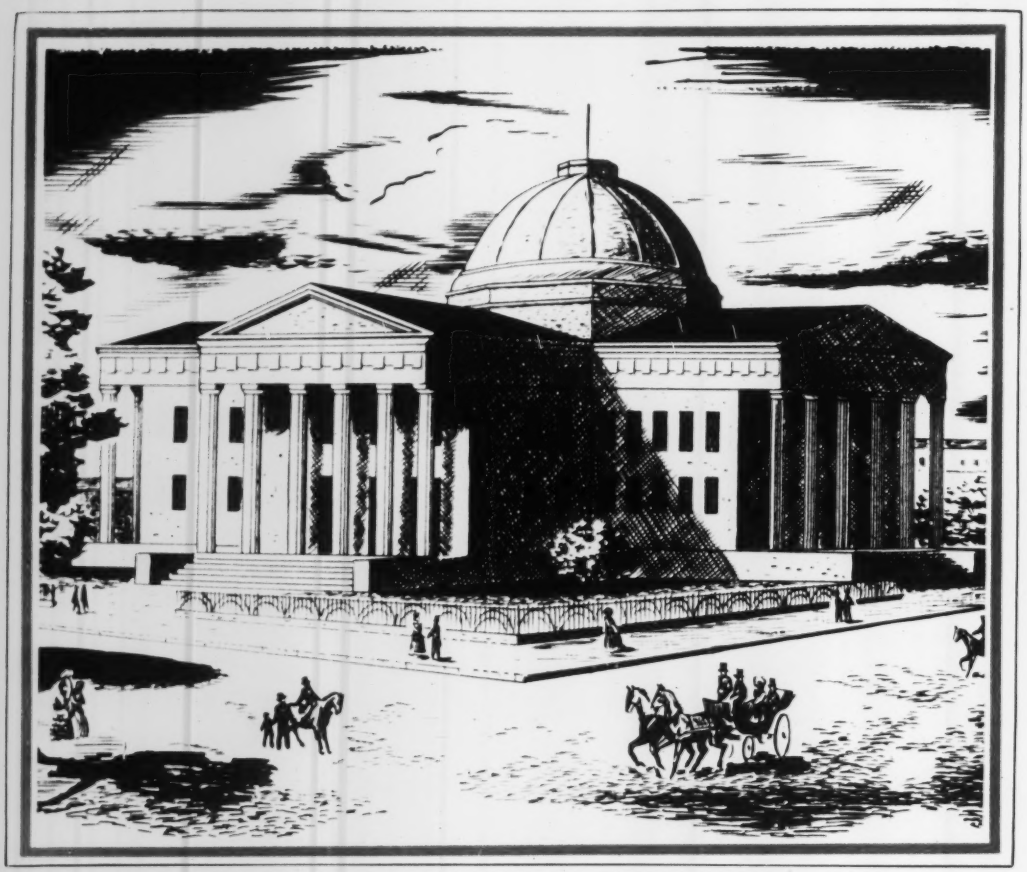
Below: This "Cat" D8 Tractor with sheepsfoot tamper works steadily compacting fill. Contractors: D. & H. Construction Co. and M. H. Hasler Construction Co.



Helping contractors speed various phases of construction are many "Caterpillar" Diesel Engines, Tractors, Motor Graders and Earth-moving Equipment. As on other projects, the big yellow engines and machines are giving a good account of themselves. Ruggedly built, they stay on the job day after day with a minimum of down-time. And extra hours of operation at lower cost are being added by proper maintenance—a matter of only a few minutes a day per unit. Good service from the nearby "Caterpillar" Dealer also helps step up their record of performance.

Drilling shot holes for power house excavation is a phase in which "Caterpillar" equipment is used. Compressed air is supplied by two Gardner Denver and two Chicago Pneumatic Compressors, each powered by a D13000 Engine. Contractor: Guy F. Atkinson Co.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS



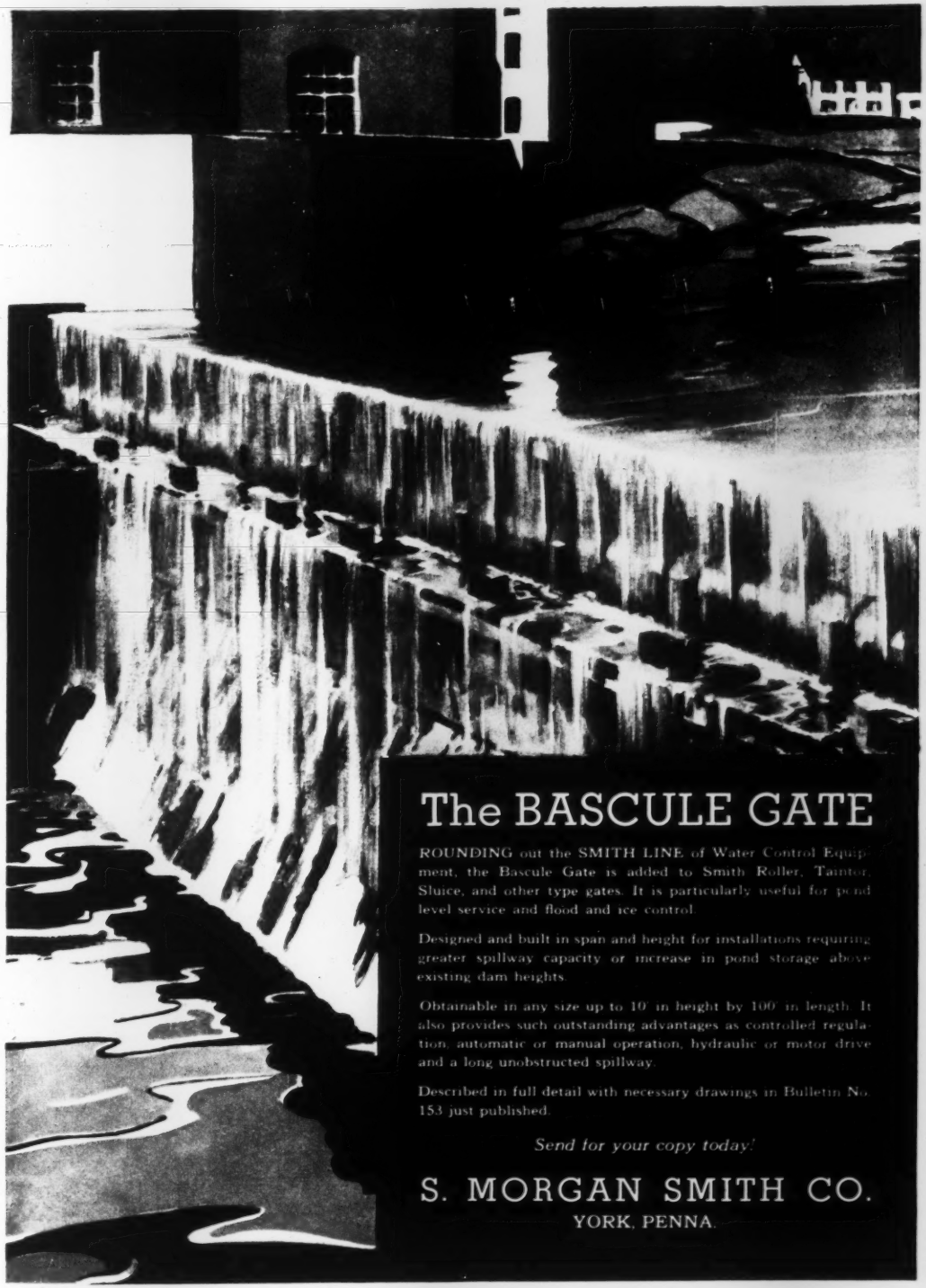
The old courthouse in St. Louis as it looked 100 years ago

St. Louis, Missouri has a cast iron water main in service that was installed more than 100 years ago. That is not surprising as St. Louis is one of our oldest cities, founded by the French and taken over by the U. S. A. with the Louisiana Purchase. Yet this old main is still withstanding the traffic shock and beam stresses imposed by multi-ton trucks and congested underground utility services in a great manufacturing city. More than thirty other American cities have cast iron water and gas mains in service that were installed over a century ago—indisputable testimony to the strength factors of long life inherent in cast iron pipe.

United States Pipe and Foundry Company, General Offices, Burlington, N. J. Plants and Sales Offices Throughout the U. S. A.

U.S. cast iron PIPE

FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE



The BASCULE GATE

ROUNDING out the SMITH LINE of Water Control Equipment, the Bascule Gate is added to Smith Roller, Tainter, Sluice, and other type gates. It is particularly useful for pond level service and flood and ice control.

Designed and built in span and height for installations requiring greater spillway capacity or increase in pond storage above existing dam heights.

Obtainable in any size up to 10' in height by 100' in length. It also provides such outstanding advantages as controlled regulation, automatic or manual operation, hydraulic or motor drive and a long unobstructed spillway.

Described in full detail with necessary drawings in Bulletin No. 153 just published.

Send for your copy today!

S. MORGAN SMITH CO.

YORK, PENNA.

Why cast iron pipe

can and does save

Millions of Tax Dollars

The answer, of course, is (1) cast iron pipe serves for centuries, and (2) over 95% of the pipe in service in America's water distribution systems is cast iron pipe. But let's get down to figures.

The cumulative cost of our water supply systems, from 1817 to 1951, is estimated at $6-billion, of which more than $3.5-billion is for cast iron pipe, including installation costs. The balance is for pumping stations, filter plants, storage facilities, etc.

Most of this money was raised by the issuance of bonds. Now, the useful life of cast iron pipe is at least 4 to 5 times the average term of a water revenue bond issue. Records prove that more than 35 American cities have cast iron mains in service that were installed over 100 years ago. A survey sponsored by three waterworks associations shows that 96% of all six-inch and larger cast iron pipe *ever laid* in 25 representative cities is still in service.

Add it all up and the answer is clear that, by serving for generations after bonds issued to pay for them have been retired and forgotten, cast iron mains save many millions of tax dollars.

One of a number of cast iron water mains which have been in service in New York City for more than a century. Over 35 other cities have century-old cast iron mains in service.

CAST IRON ®

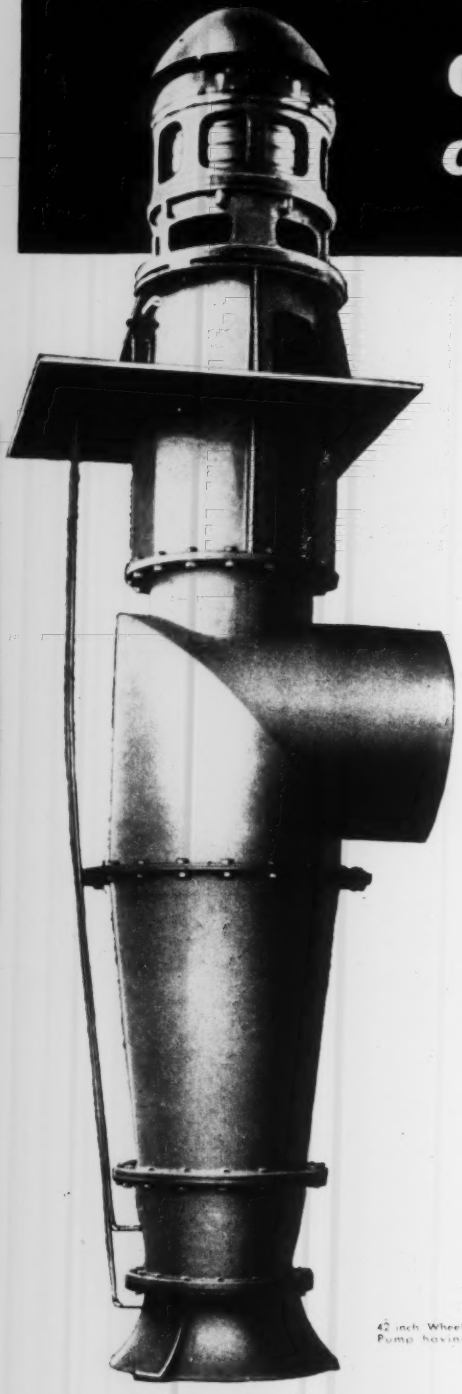
CAST IRON PIPE

America's No. 1 Tax Saver

© 1952, Cast Iron Pipe Research Association

CAST IRON PIPE RESEARCH ASSOCIATION, THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

C. H. WHEELER & CONSOLIDATE TO



42 inch Wheeler Economy Vertical Axial Flow Pump having capacity of 40,000 G.P.M.

Economy Pumps, Inc. and C. H. Wheeler Manufacturing Company have consolidated engineering and manufacturing facilities in C. H. Wheeler's plant at Philadelphia. Facilities are now being expanded through new construction and the installation of additional modern machine tool equipment.

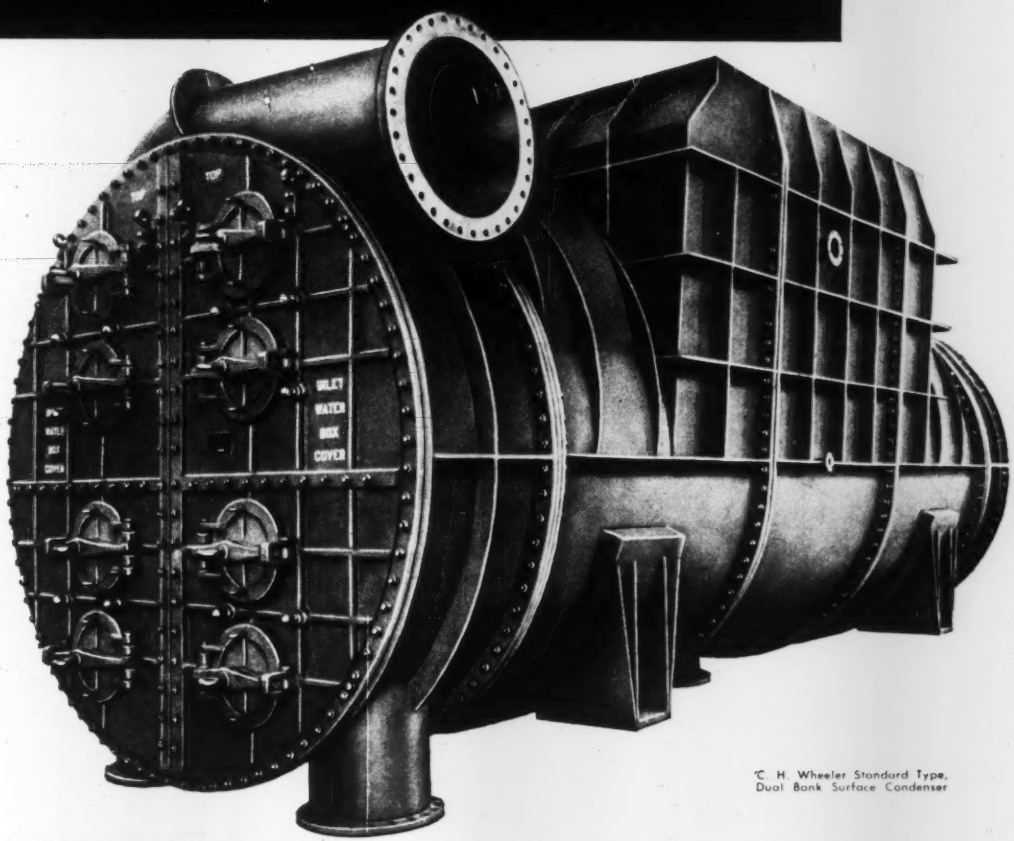
PUMPS . . . Economy has for many years been among the leaders in the engineering and manufacture of centrifugal, axial and mixed flow pumps. Today, the Wheeler-Economy line is one of the most modern and complete in the pumping industry.

CONDENSERS & POWER PLANT EQUIPMENT . . . The C. H. Wheeler Manufacturing Company has contributed many of the outstanding developments in the field of condensing apparatus and vacuum problems. Nearly a decade ago, C. H. Wheeler adopted Economy mixed flow pumps for use with their condensers.

PROCESS EQUIPMENT . . . C. H. Wheeler is also internationally known for Cooling Towers, Steam Jet vacuum apparatus and Fine Particle Reduction Mills, vital links in modern chemical and food processes. Wheeler-Economy Pumps will round out the company's services in these fields.

MARINE GEAR . . . C. H. Wheeler's Marine Gear, Condenser and Deck Machinery department will be augmented by Wheeler-Economy Pumps designed for marine application.

ECONOMY PUMPS, Inc.
SERVE YOU BETTER . . .



C. H. Wheeler Standard Type, Dual Bank Surface Condenser

WHEELER-ECONOMY PUMPS

. . . a new name combining old names that have been known and respected for generations. All the experience and metal working techniques this consolidation brings together are of great importance to you — our customer. Wheeler-Economy Pumps will fill your every requirement regardless of size or problem involved. Write to Philadelphia or to the nearest Economy or Wheeler representative listed in the phone directories of principal cities.

113

WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC. · DIVISION OF C. H. WHEELER MANUFACTURING CO.
19TH AND LEHIGH, PHILADELPHIA 32, PA.

DANTE PLACE
PUBLIC HOUSING
PROJECT
BUFFALO MUNICIPAL
HOUSING
AUTHORITY

Bids on alternate designs show reinforced concrete saves 6.76% . . . cuts steel requirements 50%

In planning this 616-unit public housing project, the Buffalo, N. Y., Municipal Housing Authority ran exhaustive cost studies to determine which type of building frame would be less expensive — reinforced concrete or structural steel. Costs for the project had to be estimated closely, before appropriations could be made.

Engineers of the Housing Authority prepared a complete floor and column design for one building for both structural steel and reinforced concrete. In addition, a separate structural steel design was prepared by an outside engineer. Then all three designs were submitted to contractors for preliminary pricing.

The results are shown on the opposite page. Reinforced concrete won hands down. It offered a clear saving of 6.76% of the general contract cost, or $270,038.06! Furthermore, reinforced concrete used 2,350 fewer tons of steel, urgently needed for national defense.

Savings like these are typical of those realized by builders all over the country with reinforced concrete. And reinforced concrete *is not only* economical . . . it is inherently firesafe, and provides a permanent, rugged structure which is highly resistant to wind, shock, and quakes.

On your next structure, *design for reinforced concrete!*

ARCHITECTS: Backus, Crane & Love;
MECHANICAL ENGINEERS: Beman & Candee;
STRUCTURAL ENGINEER: James N. De Serio, P.E.

saved ...$270,038.00

AND 2,350 TONS OF STEEL

BY BUILDING WITH

REINFORCED CONCRETE

COSTS PER SQUARE FOOT (Preliminary Designs)

	Concrete Frame	Steel Frame Design #1	Steel Frame Design #2
Engineer's Estimate	$1.825	$2.335	$2.302
Contractor A, N. Y. C.	1.68	.....	.....
Contractor B, N. Y. C.	1.81	.....	.....
Contractor C, Buffalo	1.945	2.499	2.41
Contractor D, Buffalo	2.178	.....	2.053
Contractor E, Buffalo	No estimate, but stated concrete was cheaper		

ESTIMATED STEEL (Tons)

	Steel Frame	Concrete Frame
Structural steel	3,400	0
Shelf angles for lintels	200	100
Reinforcing steel	800	2,100
Total	4,400	2,200*

*Actual design requirements were 2,050 tons—a net saving of 2,350 tons of steel.

SAVING IN FRAMING COSTS

Low structural steel estimate	$2.053 per sq ft
Low concrete estimate	1.680
Saving	0.373
For 616,644 sq ft of supported floor area:	
Saving in framing costs	$230,008
Saving in brickwork	28,030
Saving in plaster, partitions, etc.	12,000
Total indicated saving	$270,038

CONCRETE REINFORCING STEEL INSTITUTE
38 South Dearborn Street, Chicago 3, Illinois

How Bitumuls paved Eniwetok at "Stateside costs"

Bulk loads of easily-transported BITUMULS® made possible paving isolated Eniwetok at costs comparable to those of the California Highway Department. By million-gallon tankers, then from tanker to barges, from barges through submarine invasion pipe-line to shore tanks—Bitumuls was delivered to Eniwetok.

American Bitumuls & Asphalt Company specialists helped the engineering and construction firm of Holmes & Narver, Inc. develop a crushed coral and coral-sand mix with a special Mixing Grade of Bitumuls that is miscible even with ocean water. This stable, cold-mixed paving material was produced and placed in record time despite difficult tropical conditions on the atoll.

Proved on many offshore jobs, Mixing Grades of Bitumuls are ideal for treating virtually all available aggregates. Quick-Setting Grades of Bitumuls are favored the world over for armorcoat and macadam work. High Viscosity Bitumuls is recognized by most state highway departments as standard for surface treating.

Nation-wide there are Bitumuls Engineers working out of strategically located plants. These men are specialists, qualified by training and varied experience to consult with you, to your advantage, about your paving needs . . . roads, parking areas, airports.

Bitumuls is ready for prompt delivery to your job site.

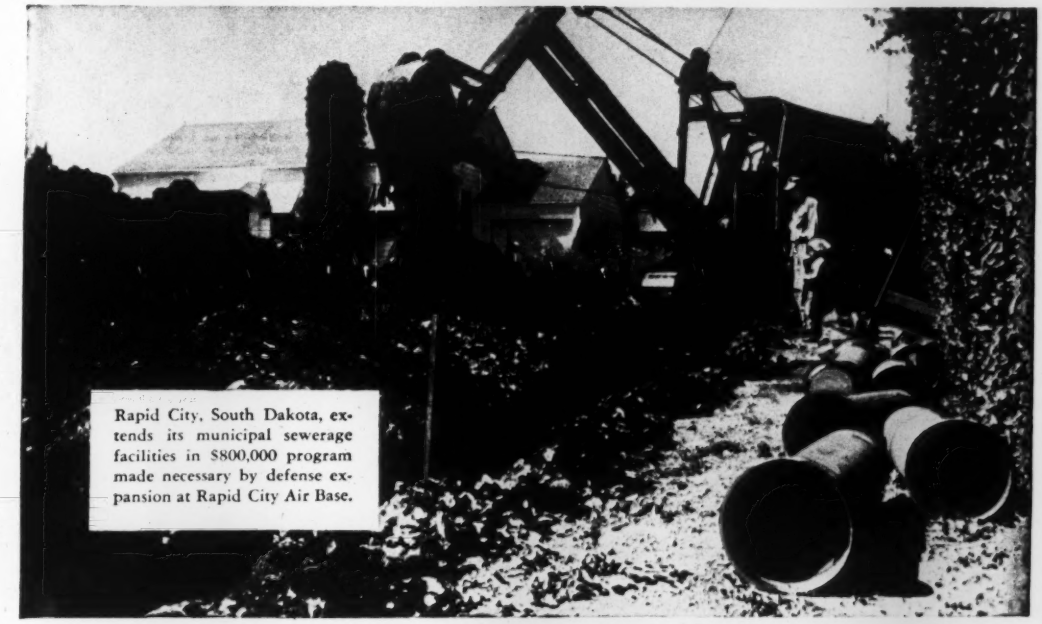
AMERICAN
Bitumuls & Asphalt
COMPANY

200 BUSH ST. • SAN FRANCISCO 4, CALIFORNIA

Providence 14, R. I. Perth Amboy, N. J. Baltimore 3, Md. Columbus 15, Ohio
St. Louis 17, Mo. Mobile, Ala. Baton Rouge 2, La. Tucson, Ariz. Inglewood, Calif.
Oakland 1, Calif. Portland 7, Ore. Seattle, Wash. Washington 6, D. C. San Juan 23, P. R.

MANUFACTURERS OF ASPHALT AND ASPHALTIC PRODUCTS

CLAY PIPE—*ESSENTIAL* ★ *ECONOMICAL* ★ *EVERLASTING*



Rapid City, South Dakota, extends its municipal sewerage facilities in $800,000 program made necessary by defense expansion at Rapid City Air Base.

15 Miles of CLAY PIPE GO INTO RAPID CITY MUNICIPAL SEWER EXPANSION

Over 15 miles of Vitrified Clay Pipe, in sizes ranging from eight to 33 inches, are being installed to give sewerage facilities to some 900 new homes in Rapid City. Clay Pipe provides these new residents with *permanent* sanitary service—a never-wear-out system that will guard the city's health for years and decades to come.

Clay Pipe is the *only* pipe that's unaffected by acids and alkalies . . . by rust, rot, decay, or sewage gases. It's the one chemically-inert pipe that has *proved* its resistance to chemical action through actual performance in the ground. Don't take chances with substitute sewerage materials. Specify Vitrified Clay Pipe . . . *it never wears out!*

NATIONAL CLAY PIPE MANUFACTURERS, INC.

311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
206 Connally Bldg., Atlanta 3, Ga.

Vitrified Clay Pipe . . . Specified Wherever Reliable, Performance-Proved Pipe Is Needed

Orlando, Fla. (Air Force Base)	74,000 ft.	Needles, Calif. (Essential Ore)	87,000 ft.
Morrisville, Pa. (New Steel Defense Plant)	300,000 ft.	Hartford, N. Y. (Electronic Plant Expansion)	50,000 ft.
Eynon, Pa. (Gun Fire Control Plant)	120,000 ft.	Willow Springs, Ill. (Jet Engine Plant Expansion)	16,000 ft.
Marion, N. C. (Municipal Sewerage)	32,000 ft.	Limestone, Me. (Air Force Base)	65,000 ft.

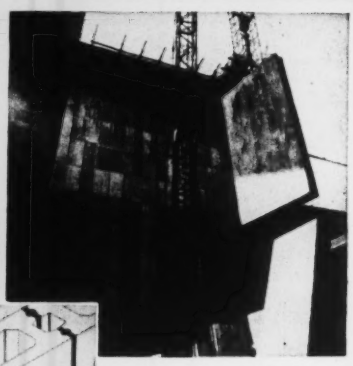
Vitrified
CLAY
CLAY PIPE NEVER WEARS OUT!
PIPE

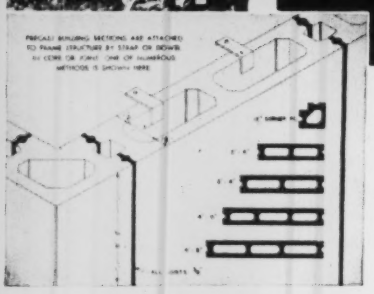
C-652-3

TOMORROW'S WALL *Today!*

48 Sq. Ft. of Finished Wall Erected in 8 Minutes

Wall panels are quickly erected by crane. Scaffold and hoist on photo above are for other purposes.





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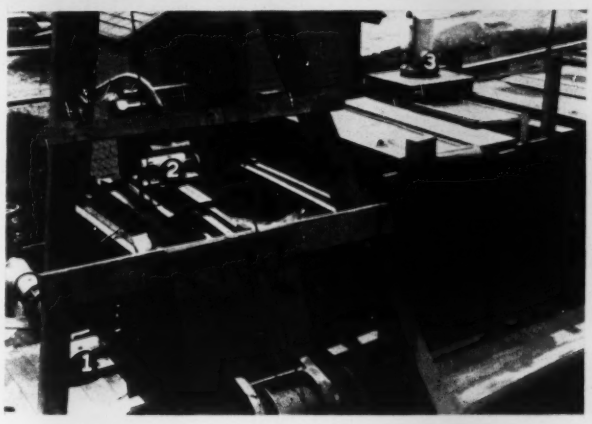
Invasion of sea water into domestic water-well field of City of Manhattan Beach, above, has caused successive abandonment of wells up to a mile inland from shore. Numbered wells in panorama, looking west, have been abandoned. Test wells (T.W.) are drilled to determine progress of salt-water invasion. Effect of water recharged into well No. 7, which is located 4,500 ft inland, was measured and sampled at other wells.



Well No. 7, Manhattan Beach, right, takes 1.5 cfs through pump column into 16-in. casing. Hoist and rod over center of well control gravity flow of solid column of water through valve at bottom of pump column. Recorders, left to right, measure (1) water level in well, (2) head on valve, and (3) water level on V-notch weir in measuring flume.

Recharging wells expected to stem sea-water intrusion

California to spend $750,000 on pilot test

FINLEY B. LAVERTY, M. ASCE,

Chief Hydraulic Engineer, Los Angeles County Flood Control District, Los Angeles, Calif.

When Mendenhall surveyed the ground-water conditions of California's South Coastal Plain for the U. S. Geological Survey in 1900, he found one area where the ground-water levels had little potential to prevent sea-water intrusion. This area, which is known as the West Coastal Basin of Los Angeles County, extends from the ocean some 6 to 8 miles inland to the Inglewood-Newport Fault and northerly along the coast from the Palos Verdes Hills to Ballona Creek. Currently ground-water levels in this area have dropped to as much as 50 ft below sea level within 4 miles of the coast line, and the 250-ppm chloride line is moving inland more and more rapidly. The first loss of wells due to sea-water intrusion occurred in the early twenties. By 1931, the mineral constituents in the ground water 2,000 ft inland at Manhattan Beach were in excess of the standards adopted for drinking water. By 1950 this condition existed 7,000 to 8,000 ft from the shore, and in the past year, a test well indicated that the 250-ppm isochlor may lie another 500 ft inland.

This hazard to a basin which is the principal source of water supply for major industries, refineries, and airplane plants, and for a sizable population, has caused such concern that prevention of further sea-water in-

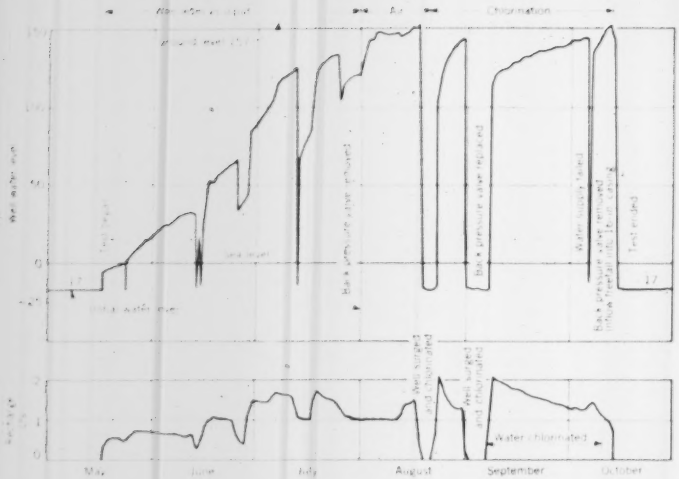


FIG. 1. Recharge test in Manhattan Beach, Calif., well No. 7 indicated that optimum recharge rate was obtained by preventing entrainment of air in recharge water, and by chlorinating input (15 ppm) to retard growth of bacterial slimes in open pore spaces around well.

trusion has been under study since 1931 by the Los Angeles County Flood Control District (the county water conservation agency), the State Division of Water Resources, the USGS, and by consultants employed by the West Basin Water Association which represents the local cities and industries.

From these studies have come the following suggested solutions:

1. Raise basin water levels above sea level by pumping decrease.
2. Raise basin water levels above sea level by direct recharge.
3. Maintain a fresh water ridge or salt water intrusion barrier along the coast.
4. Develop a pumping trough along the coast line.
5. Construct artificial subsurface dikes.

Solution 1 has been approached by limiting pumping through adjudication of ground water supplies and by supplying Colorado River water through the Metropolitan Water District. So far, these means have been too slow to stem the sea water pollution. Solutions 4 and 5 are thought to be uneconomic. Solution 2 appears to be a possible by-product of Solution 3—that is, maintenance of a fresh water ridge along the coast to reverse the existing landward gradient. To study Solution 3 in a preliminary manner, the Flood Control District initiated a series of tests in May 1950.

Capping clays create pressure aquifers extending along more than three-quarters of the Basin's shore line and several miles inland. It was known that these pumping sources formerly produced fresh water springs in the ocean several miles offshore, and that it was not possible to build up a fresh water ridge or mound by surface infiltration. Therefore, the abandoned well field at the City of Manhattan Beach, shown in the panorama, was chosen for a well recharge test to determine the feasibility of recharging through wells, and the possibility of creating a pressure cone and a seaward hydraulic gradient in the water-bearing zone. The city has been pumping from its fresh inland wells during part of each day, and using treated Colorado River water for the balance of its supply. Hence the available recharge water was a mixture of these supplies.

Recharge Well Tested

The accompanying photograph shows the measuring flume discharging over a V-notch weir into the funnel box which fed the 6-in. pump column in well No. 7. The bottom of the column was fitted with a back-pressure valve, which discharged the flow against the varying head in the 16-in. well casing and also maintained a level in the funnel box that prevented air being mixed with the water entering the well. Air entrained in water being injected into the ground causes blocking of underground pore spaces.

Prior to the test, the well-water surface elevation was 17 ft below mean sea level, and pumped water samples tested 1,200 ppm of chlorides. Casing perforations are in sandy gravels between 230 and 260 ft from the top of the well, which is at El. 157. Two clay layers which show continuity in adjacent wells and total 31 ft in depth are just above the perforations.

Well input in cfs and water-surface elevations, from the beginning of the test in May 1950 until its conclusion in October 1950, are shown in Fig. 1. The test was in three principal phases: (1) to determine relation of well head to various rates of input, (2) to determine detrimental effect of air entrainment on input, and (3) to determine beneficial effect of chlorinating the inflow in amounts varying from 8 to 41 ppm.

Prior to the test and between its phases, the well was surged to open up congested ground at casing perforations, chlorinated to kill slime-forming bacteria, and pumped to clean up the well. In this connection it is interesting to note that the production of the well just prior to the test was 320 gpm with a 22-ft drawdown and that during subsequent pumping periods of about 10 hours each, all chloride samples showed the same value as the recharged water (70 to 90 ppm), indicating that the fresh water and saline ground-water did not mix.

The following data and conclusions drawn from this recharge test appear to be of most significance:

1. With conditions as in the test well, it seems practical to recharge with water of similar quality at rates above 1 cfs for several months, without cleaning the well by surging or pumping, if the water is dosed with about 15 ppm of chlorine to kill bacteria that produce pore-clogging slimes.
2. The recharge water moved inland at the rate of about 8 ft per day.
3. The height of the pressure mound was found to be proportional to the rate of input.
4. The sketchy mound data from the single recharge well suggest that a well spacing of 500 ft will create a continuous mound.

Pilot Program to Confirm Test

Available geological and well data show a wide range of depth of water-bearing material (59 ft at well No. 7), permeability varying from 0.00167 to 0.00278 fps under a unit hy-

draulic gradient (6 to 10 ft per hour), and inland hydraulic pressure gradients varying from 0.002 to 0.004.

It is obvious that the planning of a complete sea-water intrusion barrier program could not be economically sound or practically sure of operation with such wide variables in basic data. Hence, the Manhattan well test and other currently available information are being used as the basis for planning a pilot program of recharge wells to extend nearly two miles along the coast line.

The location of this program is shown in Fig. 2. Its initial phase consists of eleven wells spaced 500 ft apart in a line parallel to and some 2,000 ft inland from the coast. The hydraulic pressure levels in this reach are about 10 ft below sea level. Therefore it will be necessary to create a pressure ridge with an average height of at least 10 ft parallel to the coast.

In recharging through a line of properly spaced wells, the resultant barrier would consist of a series of alternating peaks and valleys with lateral flow restricted by influence from the adjacent wells and a decreasing seaward gradient. If the well spacing were sufficiently close, the mounds would merge and the recharging could be considered as originating from a continuous trench. However, it must be realized as a practical consideration that initial recharge will supply water radially from all wells.

Considering the distance of the wells from the ocean, it may be expected that a rapid build-up of the fresh water ridge will first occur between the adjacent recharge well cones while the seaward wedge will build up more slowly. As the seaward gradient decreases, both the inflowing sea water and the recharge flow toward the sea will decrease until stability is reached when the gradient is reduced to practically zero. Under such a condition it could be assumed that the barrier would be at sea level and that the flow landward would stabilize, with the saline intrusion checked. Under these conditions the flow from the fresh-water ridge would be limited to a landward direction normal to a vertical plane through the line of recharge wells and under the hydraulic gradient necessary to convey the water landward at the same rate of flow required to maintain the ridge.

The extent of the pilot program is limited by the availability of the imported water supply—that is, the present capacity of Metropolitan Water District distribution lines. The maximum recharge flow requirement is expected to be 30 cfs. To bring the Metropolitan Water District water to the line of wells, 7,300 ft of pipe will be required, with an additional 10,000 ft of pipeline needed for distributing the supply to the wells. A central chlorination plant would dose all recharge water. Observation wells of 8-in. diameter would be drilled to follow the development of the mound at two or three key locations normal to the well line.

The estimated cost of this pilot program, including permanent facilities, water supply for one year at $21 per acre-ft, operation and maintenance personnel, and engineering is approximately $690,000.

State Legislature Provides Funds

As a result of these findings of the Los Angeles County Flood Control District, the West Basin Water Association presented the pilot program to the state legislature, which was already familiar with the importance of obtaining a solution to the problem of sea-water pollution of ground water. The situation had been emphasized through Assemblyman Dickey's Water Pollution Investigation Committee in a report by the State Division of Water Resources which showed 34 ground-water basins along the California coast to be polluted or seriously threatened, stating that "the most serious intrusion to date is occurring in the overdrawn West Coastal Basin in Los Angeles County and the Central Coastal Basin in Orange County."

Consequently the legislature has appropriated $750,000 to be used for investigation of means for preventing sea-water pollution. This legislative act specified allocation of funds to further investigation in the West Basin through the Los Angeles County Flood Control District and the West Basin Muncipal Water District. Detailed plans for the pilot program are under way and its installation will be started in 1952.

Should the pilot program confirm the praticability of stemming sea-water intrusion by means of recharge wells, then the flows indicated in Fig. 2 may be required. These flows may be obtained from imported water, but probably can be secured at less expense by further treatment of sewage effluents now being discharged into the ocean nearby.

From the foregoing it is indicated that practically all the recharge water will flow to the depleted ground-water basin. Hence the procedure not only has the possibility of stopping sea-water pollution, but also of satisfying the 50,000 to 75,000-acre-ft annual overdraft that now exists in the basin a trend which has been intensified by the seven drought years just experienced.

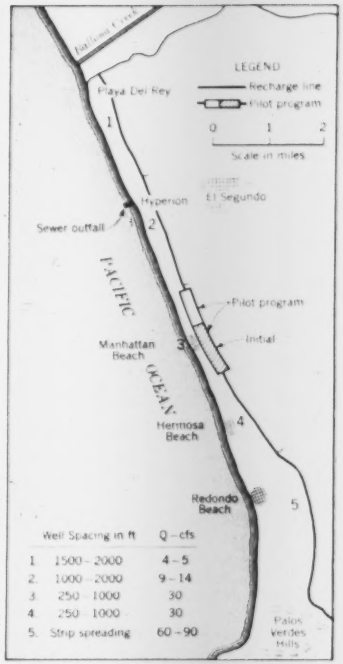


FIG. 2. Location of proposed pilot-well recharge line in West Coast Basin, for which California legislature has appropriated $750,000, is shown here. Recharge water would build up fresh-water barrier to prevent sea-water intrusion into ground-water source from which domestic supplies are taken.

Though the indicated costs of a final program to save this ground-water basin are considerable, they are small when compared with the value of the water remaining in the basin and the value of the basin as an underground storage reservior.

H. E. Hedger, M. ASCE, is Chief Engineer of the Los Angeles County Flood Control District, and Paul Baumann, M. ASCE, Assistant Chief Engineer, is in charge of the Districts' Dams and Water Conservation Branch. The writer has charge of the District's Hydraulic Division, and L. W. Jordan, A. M. ASCE, supervises the Division's Water Conservation Section, which performed the well recharge tests.

We can have increased unity in our profession

During the past several months it has been my privilege to meet with a large number of Local Sections members and to discuss with them individually and collectively one of the most important decisions facing the engineering profession. Can we develop a unity organization, and if so, how? My opinion has been requested repeatedly on all phases of the subject. It seems to me that the columns of CIVIL ENGINEERING will provide the quickest way to present my views to the largest number of our members.

The current demand for increased engineering unity came from local groups and councils of engineers in the several branches of the profession a few years ago, after Engineers Joint Council was organized. Efforts of a special committee of EJC in 1946 and 1947 for study of the subject were inconclusive.

In response to an invitation issued by EJC on June 8, 1949, representatives of 15 major engineering societies met first on October 20, 1949, and organized themselves into an "Exploratory Group" to explore the desirability and practicability of increasing unity in the engineering profession. The societies represented in the group, and the representative of each, are named in Table I.

By December 16, 1950, the Exploratory Group had developed for discussion purposes a report presenting four different plans for a unity organization. The report was distributed widely among the members of the constituent societies. The officers and the Local Sections of ASCE, through special local committees, studied it carefully. Comments and views of individuals and Local Sections were transmitted to Society Headquarters. The four plans developed in 1950 by the Exploratory Group can be summarized as follows:

Plan A, the "EJC plan," contemplates the expansion of EJC to include other engineering societies which are eligible under the present constitution of EJC.

Plan B, the "modified EJC plan," proposes to expand EJC to include other engineering societies and to provide for voluntary individual memberships.

Plan C, the "merger plan," contemplates the merger of EJC and NSPE into a single body, and the expansion of the merged organization in the ways necessary to enable it to represent the entire engineering profession.

Plan D, the "NSPE plan," proposes adoption of NSPE as the unity organization and expansion of its membership and activities through the cooperation of other engineering societies.

Responses from Local Sections, past officers, and individuals of our Society indicated that a large majority favored Plan A as the most promising basis for a unity organization. These views of our Local Sections were transmitted to the Board of Direction, and the Board agreed in the expressed preference for Plan A.

From time to time it has been suggested that a choice of the "best plan" for increasing unity be made by placing before all the members of all the interested societies an opportunity to decide by individual ballot. After the recommendation of the Exploratory Group to use Plan A as a basis became known, there was a revival in some quarters of the plebiscite idea. However, our Board felt that the method it adopted to determine the views of our members was the best method of obtaining informed and well considered answers to this extremely complicated problem.

By September 28, 1951, meetings of the Exploratory Group indicated clearly that, while differences of opinion as to the best form of organization existed, a majority of the group favored recommending Plan A. At its December 15, 1951, meeting the Exploratory Group adopted a report recommending that the "unity organization be organized first by the development of EJC along the general lines of Plan A." The representatives of fourteen societies voted for the adoption of the report and the representative of one society dissented. This report was the tangible result of study and discussion by fifteen interested societies from June 1949 to September 1951, a period of two and one-half years.

A few simple steps are recommended in the Group's report for starting the initial unity organization. First, Engineers Joint Council would invite all societies represented in the Exploratory Group to become members of EJC. Second, EJC would modify its constitution so as to provide for increased membership on Council by the representatives of the societies invited to become members. Third, the constituent societies would accept membership in EJC. These simple steps would place the enlarged EJC in a position to study and make changes as may be desired in the overall objectives of Council, in the number of representatives on Council from each member society, in the qualifications for membership of additional engineering organizations, and in provisions for membership of individuals. The problem of the affiliation of local and state societies was left for future solution, a solution which would necessarily conform in general with the principles of the plan proposed by the Exploratory Group.

At present the December 1951 report of the Exploratory Group is being considered by EJC and by the constituent societies of the Group. In New Orleans on March 3 and 4, 1952, the Board of Direction of ASCE expressed its support of the plan recommended by the Exploratory Group. EJC has directed its Constitution Committee to prepare proposed revisions of its constitution to provide for additional memberships on Council in accordance with the recommended plan.

What was the underlying reason for the renewed demand, five or six years ago, by engineers in various parts of the country for a unifying organization in the engineering profession? The failure and dissolution of American Engineering Council in 1940 created a vacuum that threatened serious consequences to the profession. A widespread opinion developed among members of the profession that EJC was the organization best fitted to represent the profession on federal legislation and on engineering subjects of common interest. There were sound grounds for these beliefs. With EJC as a national professional entity, the engineering profession was able successfully to challenge the Morgenthau Plan for the Industrial Demobilization of Germany and Japan, and to secure an opportunity to report its own convictions and recommendations. Under the leadership of EJC, provisions of

CARLTON S. PROCTOR, President, ASCE,
and Representative of ASCE on Exploratory Group for Increased Unity in the Engineering Profession

law giving freedom to professional employees to join or refrain from joining labor unions were written into the Taft Hartley Act. Through the efforts of EJC, engineers were included on the National Science Foundation, and engineering research was recognized in national science legislation as being essential to the welfare of the country. Engineering was given scant recognition in the early days of the UNESCO organization, but as the result of persistent efforts by EJC, the profession has had substantial representation for years in the person of Council's appointees. An accomplishment of high significance was the incorporation in the Army Reorganization Act of 1950 of provisions which furnish statutory guarantee of professional status for the officers of the Corps of Engineers, and of the Ordnance, Chemical Warfare, and Signal Corps. As originally written the Act afforded no recognition whatever to engineering as a profession. Other EJC services in the public interest which have been generally acclaimed by the profession and by the public are exemplified by the excellent work of its Water Resources Panel, its Engineering Manpower Commission, and its National Engineers Committee. Engineers Joint Council has functioned satisfactorily and successfully in the interest of the profession and the public.

My close affiliation with American Engineering Council for four or five years preceding its demise convinces me that there were two major reasons for its break-up. First, it was administered by appointees from the Founder Societies who, as time passed, lost close contact with the boards of directors that had appointed them. The result was that many of the objectives and activities of AEC were not in harmony with the then current objectives of the Founder Societies. Second, AEC, with its separate secretariat and office, was largely dependent for financial support on yearly appropriation of funds by the Founder Societies. During the depression of the early 30's, when minimum essential budgets required deficit financing, continuance of AEC financing was considered by two of the four Founder Society boards to be a luxury they could not afford.

Obviously these two potential sources of failure must not be allowed to operate against the unity organization now contemplated. Only through the EJC principle of close and continuing ties between the governing boards of our large and influential engineering societies and the governing board of the proposed unity organization that is, a perpetually overlapping directorate—will the healthy growth and effectiveness of the unity organization be possible. There must be a common approach and common intent. The expense of operating the unity organization must continue to be kept at a minimum.

Plan B can be integrated with Plan A if found desirable. The question then arises, what about Plans C and D? Of the four plans considered, Plans C and D presuppose an ever-present harmony of interests and objectives among all the diversified branches of engineering. We all know that there are essential differences in the various branches of engineering practice which have created many diverging approaches and goals. For example, civil engineering is and must be by its very nature highly individualistic and primarily desirous of maintaining the rights and privileges of individuals and of small enterprises. Some other branches of the profession are and should be primarily interested in large corporate entities, in restrictions on the development of industry, in ever-growing federal regulations, and in tax-supported industrial competition.

The barest hope for the success of Plan C or D would demand that the Founder Societies and other societies joining such an organization relinquish all their activities not purely technical or scientific. Such an abdication of their constitutional objectives would be suicidal to such societies. Strip away the professional, ethical and public-interest activities of ASCE and we would be left with a dull and lifeless organization of little meaning or value.

Of deepest significance in this Centennial year is our professional awakening to the fact that, without engineering leadership in public thinking and in the solution of the many problems arising from our inventions, innovations, and public betterments, our profession and our country face the risk of the stagnation of socialism. Socialized engineering would be engineering without imagination, aspiration or inspiration. It would be a dead profession. ASCE never could stand mute against such an eventuality and we join our friends gladly in combating the trend toward socialized engineering.

My basic criticism of Plan A, with the modifications recommended by the Exploratory Group, has been that it contemplates too great an initial organizational expansion. It is trying to run before it can crawl, and it proposes too many organizations of diversified interest joining EJC at the same time. However, I believe wholeheartedly in the democratic process. After nearly three years of continuing conscientious deliberation, the representatives of fourteen out of fifteen societies in the Exploratory Group have recommended a plan. I will go along with this plan, and give the best of my efforts toward its success. I am convinced that, with continued cooperation among our engineering societies, we can develop a more unified engineering profession.

TABLE I. Exploratory Group on Unity Organization

Constituent Societies and Their Representatives

SOCIETY	REPRESENTATIVE
American Association of Engineers	James H. Griffin
American Institute of Chemical Engineers	Dr. L. W. Bass
American Institute of Electrical Engineers	F. G. LeClair
American Institute of Mining and Metallurgical Engineers	James E. Head
American Society for Engineering Education	Dean Thorndike Saville
American Society of Civil Engineers	Carlton S. Proctor
American Society of Heating and Ventilating Engineers	Dean L. E. Seeley
The American Society of Mechanical Engineers	Edgar J. Kates
American Society of Refrigerating Engineers	Prof. Burgess H. Jennings
American Water Works Association	Harry E. Jordan
Illuminating Engineering Society	S. B. Williams
Institute of Aeronautical Sciences	S. Paul Johnson
Institute of Radio Engineers	Dr. B. E. Shackelford
National Society of Professional Engineers	Alex Van Praag, Jr.
The Society of Naval Architects and Marine Engineers	L. H. King
* * * *	
R. E. Dougherty, President, Engineers Joint Council, 1949	H. S. Osborne, Secretary, Exploratory Group on Unity

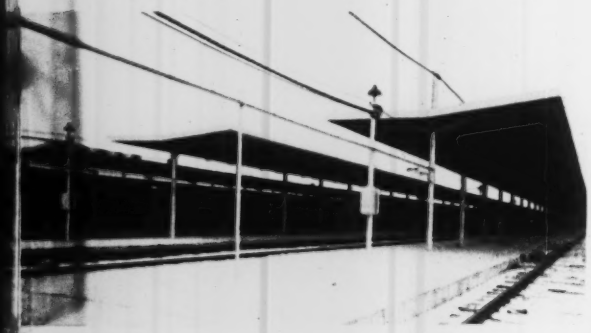
New Orleans Builds $50,000,000

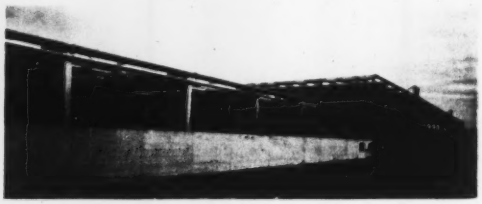
Eight rail lines using

Illinois Central Railroad's Union Station, one of five stations in New Orleans, will be demolished on completion of Union Passenger Terminal now under construction.

Four warehouses, several small dwellings, and existing rail facilities were demolished to make way for permanent passenger platforms and canopies recently completed. They will serve New Orlean's new railroad station.

Grade beams for new station building are shown above under construction. Building is expected to be ready for occupancy in 1953. Coach and pullman-car service building, below, now under construction and scheduled for completion in 1952, occupies site of old coach-yard tracks.





NO LONGER a city with a railroad station on every corner, New Orleans will soon have a centrally located Union Passenger Terminal replacing five outmoded structures used by eight railroads. Joint use of approach tracks, and construction of 27 modern overpass and underpass structures, will eliminate 144 former traffic-blocking grade crossings. When completed the Union Passenger Terminal will be owned by the city. Construction is being financed by revenue bonds issued by the city and guaranteed jointly and severally by the carriers. The articles which follow, based on papers presented at the New Orleans Convention, record the wholehearted cooperation among the railroads and the city which made the project possible, and the methods used in solving several major engineering construction problems. The terminal project was begun in 1948, and completion is expected in 1953.

In 1718 the French explorer, Jean Bienville, discovered a bend in the Mississippi River about 90 miles from the Gulf of Mexico, and there he established the settlement that has since become the city of New Orleans. He could not have chosen a worse site in North America from the standpoint of soil and drainage conditions, although the selection was wise in other respects as evidenced by the success of New Orleans as a port.

One of the prime factors in the growth of the Port of New Orleans has been the development of rail access to the city. Since 1830, when the first railroad to serve the city was built, eight major trunk lines have been constructed into the very heart of New Orleans and the city has grown up along these lines. The railroad lines radiate from the heart of town from the Mississippi River on the west to Lake Borgne on the east.

While the railroads have helped the city grow, their presence has created traffic conditions which, over the years, have become intolerable. There are five separate passenger stations serving the eight railroads. The approach tracks to these stations cross 144 city streets at grade. The resulting delays and hazards to street traffic have become extremely serious.

Many engineering studies looking for a solution of the problem by means of grade separations were made. All these studies recognized that grade

Union Passenger Terminal Project

five stations construct single terminal

C. J. WALLACE

Terminal Manager and Chief Engineer, New Orleans Union Passenger Terminal New Orleans, La.

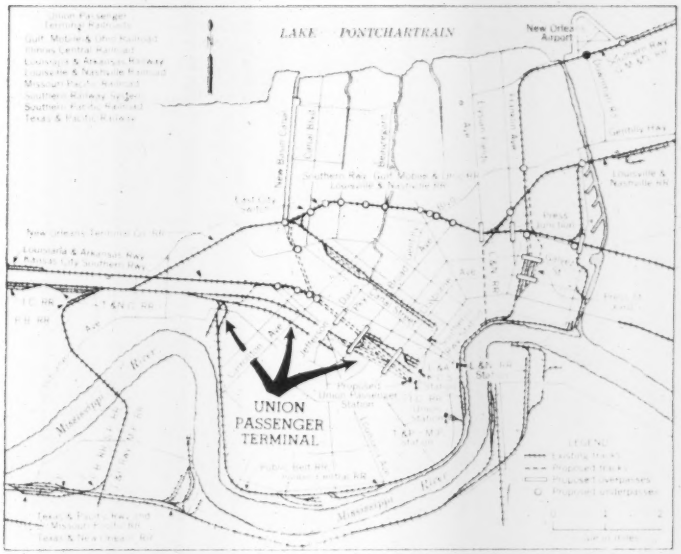


FIG. 1. New Orleans Union Passenger Terminal and Grade Crossing Elimination Program is scheduled for completion in 1953. To be owned by city, this $50,000,000 project involves bringing eight trunk railroads into one passenger station, elimination of 144 grade crossings, and construction of 27 grade-separation structures. New tracks are indicated by dashed lines, overpasses by rectangles, and underpasses by circles.

separation for so many street crossings would be prohibitive in cost and recommended consolidation of the various rail approaches and the substitution of one new station for the five existing passenger stations as an essential step in the solution of the problem.

At the completion of World War II, a seven-man board consisting of leading businessmen was appointed by former Mayor Robert S. Maestri and continued by Mayor de Lesseps S. Morrison, to represent the city and to reach agreement with the railroads on a Union Passenger Terminal and Grade Separation Program. This body, known as the New Orleans Railroad Terminal Board, negotiated an agreement that was signed October 22, 1947. The agreement contained provision for, and a general plan of, a passenger terminal; provision for 27 grade separations; elimination of grade crossings not separated; and extensive abandonment and relocation of rail lines.

By consolidating the railroad approaches into one, the necessary grade separations were reduced from 144 to 27. Of these 27, 8 are on the approaches to the Union Passenger Terminal, 16 on the tracks of the Southern Railway, 2 on the tracks of the Louisville and Nashville Railroad, and 1 on the tracks of the Public Belt of New Orleans. The location of the terminal and the various grade separations is shown in Fig. 1. Underpasses are indicated by circles, overpasses by rectangles.

City to Own and Operate Terminal

Since the agreement is unique in many of its provisions and may well serve as a model for the solution of grade separation problems in other cities, some of its provisions will be explained. Under the terms of the agreement, the city of New Orleans is constructing and will own, operate, and maintain a single Union Passenger Terminal, and it will compel use of the terminal by all passenger-carrying railroads entering the city. Supervision and control of the acquisition, construction, maintenance, and operation of the terminal are vested in a committee consisting of one representative of each of nine railroads, three representatives of the New Orleans Public Belt Railroad, and three representatives of the city a total of 15 members. This committee constitutes, in effect, a board of direction for the terminal. During the construction period, the city's representatives are members of the New Orleans Railroad Terminal Board. In addition to serving on the committee, their duties include supervision of design and construction of the various grade separations. When the construction program is com-

pleted, the Commission Council will appoint three men to represent the city on the committee, and the Terminal Board will cease to exist.

For the construction period, the committee is divided into Subcommittee A, consisting of representatives of the railroads, and Subcommittee B, consisting of city representatives. The function of Subcommittee B was to recommend to Subcommittee A the architects to design the new station building and to prepare, through these architects, the plans and specifications for the building, all subject to approval by the committee.

The grade separations are designed and constructed under supervision of the Terminal Board through the medium of consulting engineers employed on a fee basis for each structure. In addition, the Board employs an administrative engineer, on salary, whose duty it is to coordinate the grade separation work.

Under the terms of the agreement, ownership of the terminal is vested in the city of New Orleans. To provide the necessary funds for construction, the city issued $15,000,000 worth of revenue bonds, which are to be amortized over a 50 year period. Interest and amortization of the bonds are to be paid by the railroads using the terminal, the payment being assessed against the railroads as rental for use. Since the terminal property is owned by the city, there are no ad valorem taxes to be paid on it. However, after the bonds have been amortized, the railroads will pay as rental an amount equal to what the ad valorem taxes would be. Thus the city will eat its cake and have it, too.

The railroads also will pay the operating and maintenance costs of the terminal. These costs are to be prorated among the railroads on the basis of the number of engines and cars operated into the terminal. In addition to paying for the terminal, a portion of the revenue bond proceeds goes to pay the railroads' share of the grade separation costs, with the city paying 85 percent of the cost of the grade separations out of other funds, and the carriers responsible for 15 percent of the cost of these separations out of the Union Passenger Terminal funds.

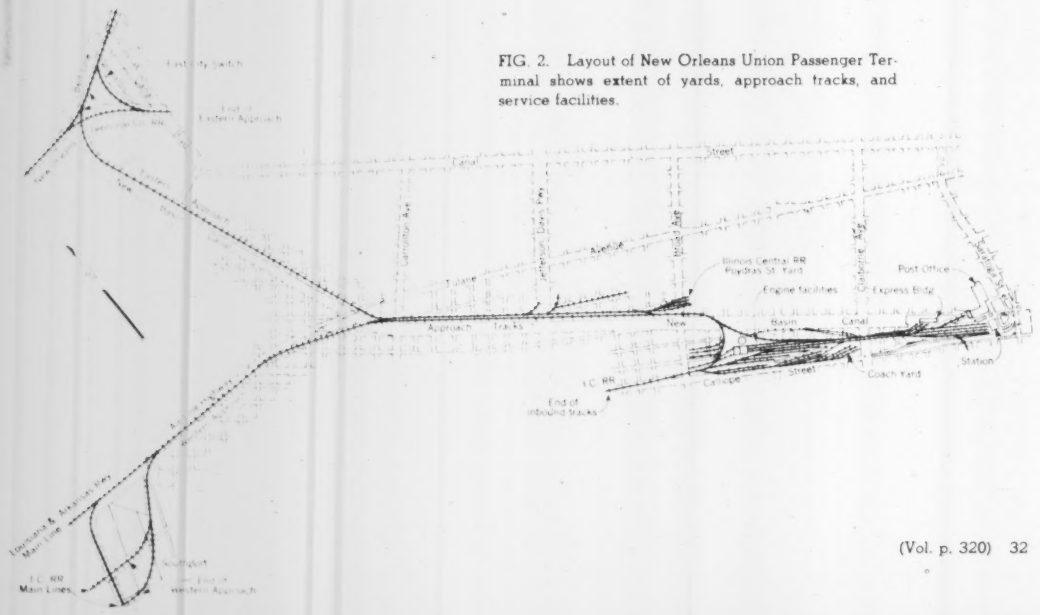
In the case of the grade separations on Union Passenger Terminal approaches, the rental paid by each carrier for use of the terminal is increased by the amount necessary to pay the interest and amortization on that portion of the bonds used for the purpose. In the case of the grade separations on the tracks of the Southern Railway and the Louisville and Nashville Railroad, the rental assessed against each of these railroads is increased by the amount necessary to pay for the interest and amortization on the bonds for that purpose.

The agreement also provides that in case the $15,000,000 revenue bond issue is insufficient to cover the entire cost of the terminal and 15 percent of the grade separation costs, each carrier will advance, on the basis of certain percentages, enough money to complete the job. Our current estimates indicate that the terminal and grade separation obligations of the carriers will amount to about $19,000,000. Thus the carriers will have to make up $4,000,000 out of their own pockets.

Another feature of the terminal agreement is the guarantee, by the railroads entering New Orleans, of payment of the revenue bonds issued by the city for the terminal. The agreement provides that this guarantee is joint, several, and in solido, and any carrier operating passenger trains into New Orleans is obligated to amortize the bond issue. All railroads entering New Orleans are compelled to use the terminal or, if they do not use it, to pay for it as though they were using it.

For accounting purposes, the terminal is divided into four zones—the Station Building Zone, the Approach and Station Tracks Zone, the Coach Yard Facilities Zone, and the Engine Facilities Zone. Payments by the carriers for use of the Station Building Zone are in proportion to the number of passenger-carrying cars moved in revenue train service into and out of the Approach and Station Tracks Zone. Payments for the Approach and Station Tracks Zone are in proportion to the number of engines and cars moved in revenue train service into and out of the Union Passenger Terminal. Payments for the Coach

FIG. 2. Layout of New Orleans Union Passenger Terminal shows extent of yards, approach tracks, and service facilities.



Yard Facilities Zone are in proportion to the number of cars handled out of the zone. Payments for the Engine Facilities Zone are in proportion to the number of locomotives dispatched from the zone. The percentages of payments among the carriers will be approximately as shown below:

CARRIER	PERCENTAGE
Gulf, Mobile & Ohio Railroad	1.92%
Illinois Central Railroad	30.94%
Louisiana & Arkansas Railway	4.86%
Louisville & Nashville Railroad	26.12%
Missouri Pacific	2.62%
Southern Railway System	9.36%
Southern Pacific	17.64%
Texas & Pacific Railway	6.54%

As a corollary to variation in the obligations of the carriers, each is entitled to increased voting power on the committee in proportion to its use of the terminal. In determining the number of votes to be cast by the individual members of the committee, the voting power of a carrier is calculated by applying its car-equivalent percentage of use to the sum of four plus twice the total carrier membership of the committee. This results in a total of 35 votes cast, of which the railroads have 29.

Grade-Separation Program

The New Orleans Railroad Terminal Board, in addition to its function as Subcommittee B and its responsibility for the grade-separation portion of the program, has charge of street work directly involving the vehicular approaches to the terminal. The Terminal Board's portion of the program is financed by a separate bond issue, which was originally for $12,000,000, to be augmented by an annual city-government appropriation of $500,000 until sufficient funds were available to complete the grade-separation and street-work portions of the project. After making one appropriation of $500,000 at the outset of the construction program, the city found it could not afford to meet its obligation in that respect. The Terminal Board sought and was granted an additional bond issue of $7,000,000 for grade separations and $4,500,000 for street improvements. Even this additional amount will not be sufficient to complete the program, and it will be necessary either to acquire more money through a bond issue or to postpone some of the grade separations. Under the terms of the agreement, certain key separations must be completed before the terminal is put in operation. Of the 27 separations named previously, 19 fall in this category. Three must be completed within 18 months after completion of the terminal, and the remainder at the city's option any time within 10 years after the completion of the terminal. In the event the city desires grade separations in addition to those contemplated by the agreement, it may construct them with the distribution of costs on the same basis as provided for in the agreement. After the terminal is completed, all remaining street crossings within the area covered by the grade-separation program are to be closed with the exception of two streets on which traffic is light.

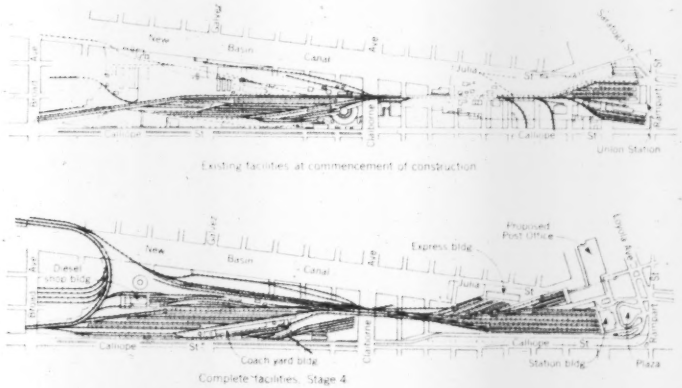
Another unique feature of the agreement is the provision for the design of the station building itself. While the Union Passenger Terminal Committee has complete supervision and control of the construction of the entire terminal, the design of the station building is the responsibility of Subcommittee B. On the recommendation of Subcommittee B and with the approval of the committee, a coalition of local architects was commissioned for the design and supervision of construction. The new station building, which will be two stories in height and will contain approximately 94,000 sq ft of floor space, is now under construction.

State Aids in Expressway Construction

In addition to its contract with the railroads covering grade separations and the Union Passenger Terminal, the city also entered into agreements with the State Highway Department and the Department of Public Works of the State of Louisiana for the filling of a portion of the New Basin Canal — a navigable waterway situated on a 300-ft right-of-way extending from Rampart Street to Lake Pontchartrain. The existence of this right-of-way in the heart of the city and adjacent to the terminal property was a fortuitous circumstance that presented many advantages. A portion of this right-of-way was turned over to the city for the construction of the Union Passenger Terminal approach tracks and to the State Highway Department for a proposed urban expressway between the existing Airline Highway and South Claiborne Avenue. As a condition for obtaining the right-of-way for the terminal tracks, the city agreed to share with the Highway Department the cost of filling the canal, the division being approximately one-third for the city and two-thirds for the Highway Department. The city's share of the cost was paid out of the proceeds of the $15,000,000 terminal bond issue. In addition, the State Highway Department agreed to construct an urban expressway connecting the existing Airline Highway with the boulevard system serving the station and, as a part of the expressway, to provide grade separations between the terminal tracks, South Claiborne Avenue and Pontchartrain Boulevard.

In addition to the terminal grade separations and street work involved in the terminal program, some of the carriers are doing work individually to help the traffic situation within the city. For instance, the Southern Railroad has abandoned its Bernadotte Yards, which were located

FIG. 3. Construction of terminal's facilities and approach tracks, which lie on alignment of tracks being used by four of carriers, required careful planning to minimize disruption to railroad operation.



east of Canal Street and extended from Jefferson Davis Parkway to City Park Avenue. Relocation of these yards in the Press Street area on the east side of town results in a vastly improved traffic situation on the main arteries in the mid town section.

Also, since the passenger operations of the Louisville & Nashville Railroad no longer need to use Elysian Fields Avenue, this line is being abandoned, and passenger trains will use the Southern Railway approaches to the terminal while freight trains will use a line through the Press Street yard area of the Southern to be constructed by the city. Other disposition has not as yet been made of four of the five passenger stations to be abandoned. The present Illinois Central station will be demolished, of course, as soon as the new Union Station is completed.

Including work to be done by the individual carriers on their own property, and funds from the Louisiana Highway Department and the State Department of Public Works, the total expenditures will somewhat exceed $40,000,000.

Trackage and Terminal Facilities Built in Stages

When completed, the Union Passenger Terminal will be an up to date facility for handling all the passenger trains of eight trunk line carriers serving the city. In addition to the passenger station, shown in Fig. 2, there will be a baggage building located immediately adjacent to the station. 12 station tracks served in pairs by 6 concrete, track level platforms with overhead canopies for the protection of passengers; a separate mail handling building, to be built as part of a new federal postoffice; and an express building served by 6 tracks with necessary car floor level platforms; 8 miles of main approach tracks equipped with the most modern signal and interlocking systems that can be devised; all facilities necessary for the servicing of locomotives; coach servicing facilities consisting of a train yard containing 10 tracks with concrete platforms between them, each equipped with steam, air, water and electrical facilities for car servicing; a large service building in the coach yard for repair work and the housing of personnel; a power plant; and a complete communication system.

The terminal is being constructed on property formerly owned by the Illinois Central Railroad and the Kansas City Southern Railway. At the time of acquisition, the operations of four major carriers were being conducted on the property. These operations have been continued with a minimum of interference during the entire construction period.

Trackage and facilities as they existed at the beginning of construction and as they will appear on completion of the work are shown in Fig. 3. Before commencing construction operations, it was necessary to provide temporary facilities. Also, since the existing express building was located on the site of the new passenger station building, it was necessary to construct the new permanent express facilities as the first unit of the passenger terminal facilities. In addition, the site to be occupied by the station tracks, platforms and canopies was encumbered with four warehouses that had to be demolished. Fortunately, the property acquired from the Illinois Central included a vacant area where the new engine facilities could be constructed without disturbing the existing facilities during the construction period. The construction of the new coach yard facilities presented the most difficult staging problem since the new yard is, for the most part, located on the exact site of the existing coach yard facilities. Here again there was a small vacant area where a start could be made without disturbing existing operations. A small freight yard and one-third of the coach yard were built in this unoccupied space so that the operations of the Illinois Central, the Southern Pacific, and the Missouri Pacific could be transferred in part to the new portion, releasing the second third for construction operations.

With the removal of the four warehouses, the permanent passenger train canopies and platforms could be constructed. Then, by using the small freight yard constructed in the first stage, an additional portion of the existing coach yard could be abandoned and the new one superimposed. Space was also available for the new powerhouse.

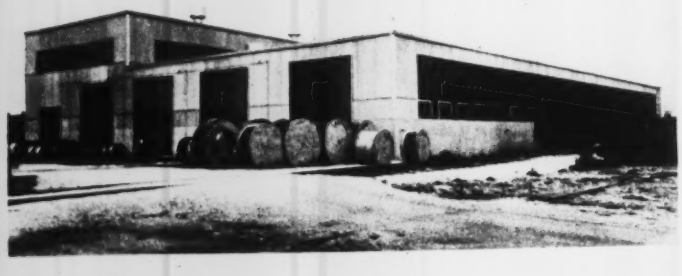
Upon completion of the second third of the coach yard, all existing operations were removed from the remainder of the original coach yard. The third stage of construction is witnessing the completion of coach yard work, including the large coach service building and the construction of the new station and baggage buildings.

The last stage of construction will see the demolition of the existing passenger station and its replacement with approach driveways, parking lot and plaza for the new station; demolition of the temporary mail facilities and completion of the permanent ones; and demolition of the existing engine facilities and replacement with storage tracks for cars. Facilities for the few remaining steam engines are a part of the diesel plant. These facilities, along with all the other facilities in the program, are shown in Fig. 3.

At the present time, work is well into the third stage of construction. If material shortages do not become worse, the job should be completed by the end of 1953.

(This article is based on a paper by the author presented during the New Orleans Convention before a session of the Construction Division, presided over by Ross White, member of the Executive Committee of the Division.)

Diesel locomotive repair shops, finished in 1951 replace old roundhouse, now abandoned



New Orleans Terminal Project

Welded continuous beams save money on key overpass structure

WALTER E. BLESSEY, A.M. ASCE

Structural Engineer, Fromherz Engineers, and Associate Professor, Tulane University, New Orleans, La.

Construction of 27 modern grade separation structures, as part of the New Orleans Union Passenger Terminal project, will eliminate 117 out of 144 traffic-laden grade crossings, saving motorists countless hours and dollars. At one crossing alone, South Claiborne Avenue, 9,180 cars out of a 25,000 traffic count are now held up daily while crossing gates are down. Already completed are the Elysian Fields Avenue, the Galvez and the North Claiborne Avenue overpasses, and the Gentilly Boulevard, Downman Road, and North Broad underpasses. The filling in of the New Basin Canal is completed. Work is well under way on the Franklin Avenue Overpass, the Franklin Avenue Underpass, the Jefferson Davis Parkway Overpass, the Canal Boulevard Underpass, the South Broad Overpass, the South Carrollton Underpass, and the Union Passenger Terminal Building.

The program time-table calls for completion of 19 separation structures simultaneously with completion of the terminal itself in 1953, then three more within 18 months, and five thereafter.

A key grade separation is the North Galvez Overpass, the subject

Six lines of floor beams in 40-ft section were lifted into place by mobile crane and butt welded to form three adjacent 81-ft continuous spans over tracks in vertical-curve portion of overpass.

North Galvez Overpass, over Press Street Yards, completed in 1951 at cost of $599,258, is part of New Orleans Grade Crossing Elimination Project. Mercury vapor lamps provide illumination.

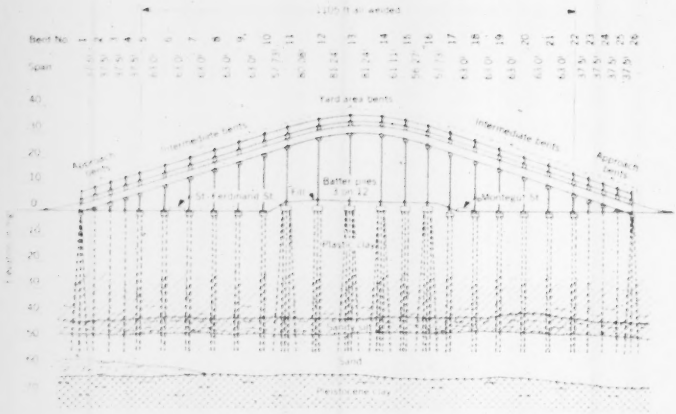
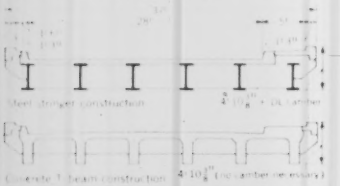


FIG. 1. Soft substrata of high moisture content required 40-ton-capacity point bearing piles 55 ft long to support concrete bents. Armco spiral welded pipe-pile shells 12¾ in. O.D., were filled with concrete after driving. Concrete deck is supported on six rows of 36-in. WF beams butt welded to form 1,105-ft continuous stringers.

FIG. 2. Typical cross section of roadway shows Galvez Overpass. Structure consists of concrete T-beam construction at each end built up to height of 5 ft, with 1,105 ft of continuous steel stringer construction connecting these approaches.



Expected differential settlement in 3-ft-high approach fill is provided for by hinged concrete approach slab.

of this article. This overpass carries North Galvez Street over the Press Street yard of the New Orleans and Northeastern Railway in the eastern part of town. (See Fig. 1, page 31).

Foundation Conditions Poor

Since the foundation design for heavy structures in this locality presents problems, a complete subsurface investigation program of test borings and test piles was conducted. Eighteen holes were bored about 100 ft apart along the site of the overpass, and undisturbed soil samples taken at intervals of approximately 5 ft in each hole down to 75 ft below mean Gulf level, except in the railroad yard area where two holes were carried to −91 and three to −125.

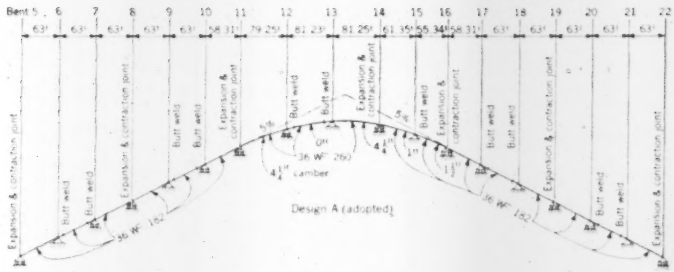
Two boring rigs worked concurrently on the job. Visual classification of the soil samples was made by the operators, and a 6-in. length of the core was then placed in a cardboard container and covered with melted paraffin for delivery to the laboratory.

From studies of the soil samples, it was decided to drive the piles through the soil deposits and into the sand stratum which begins at approximately El. − 48. The sand stratum varies in thickness from 11 ft at the west end to 20 ft at the east end and rests on a stratum of hard blue Pleistocene clay at approximately El. − 63 (Fig. 1).

Settlement computations made from the consolidation data showed that the increment of pressure due to the dead load of the structure was not sufficient to cause the soil pressure in the Pleistocene clay to exceed the maximum past pressure. Therefore, no significant settlement was predicted. This information influenced the use of continuous stringer construction. Measured settlements after the structure was opened to traffic did not exceed ¼ in.

The maximum height of earth fill that could be used for approaches to the structure depended upon the compressibility of the underlying soil and its resistance to lateral plastic flow. It was found that owing to soft pockets of clay in the underlying soil, a height of 3 ft could not be exceeded without shear failure. It was also found that if shear failure did not occur, and if the height were raised to 9 ft at the ends of the structure, a settlement of nearly 10 in. could be expected from compression of the soft stratum. Such settlement would occur slowly and impose a considerable maintenance problem. The moisture content of the soil was high, ranging from 107 to 394 percent.

For the foregoing reasons and because most fills of considerable height in the New Orleans area settle excessively and in unpredictable ways, it was decided to use a height of fill of 3 ft, then concrete T-beam construction followed by steel-stringer con-



Preliminary design loads

Bents	kips		
	DL	LL	TL
Approach	362	114	476
Intermediate	603	130	733
Yard area	1018	187	1205

DL includes weight of foundation, substructure and superstructure

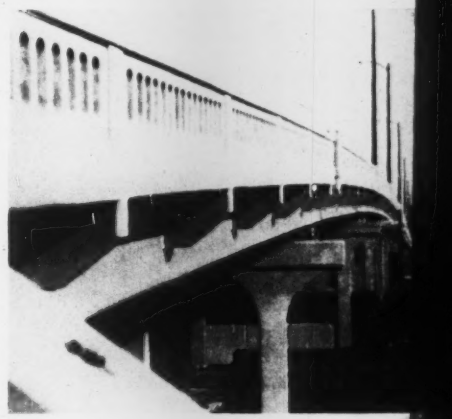


FIG. 3. Five design studies were made, both riveted and welded. Continuous-welded structural carbon steel bridge deck saved 29 tons of connecting plates, 12,000 rivets, and $13,919 over an equivalent riveted structure. Welded design required no shop work and permitted steel delivery direct from mill.

Overpass is designed for constant depth regardless of varying span length. Careful attention to this feature resulted in structure with clean lines and pleasing appearance.

struction, as shown in Fig. 2. Evidence of the soundness of this decision is the fact that settlement of approximately 1½ in. has been noted in the low approach fills. Allowance for this differential settlement was made by designing a hinged approach slab of 12-ft span bearing on the overpass roadway slab—the same principle used on the landing ramp of an LCT for unloading tanks on beaches. The break point between the concrete T-beam and the steel-stringer construction was established at 5 ft, the arbitrary limitation set up for safe proximity of steel to the natural damp grade. This resulted in four 37.5-ft spans of T-beam construction at each end of the overpass.

A point-bearing pile of 12-in. diameter at the tip was selected, and consideration given to various piles—the Raymond concrete pile, a precast concrete pile, a Union Metal Monotube pile, an H-bearing pile, the MacArthur pile, and the Armco welded-pipe pile.

The successful contractor submitted a low bid based on 12¾-in. o.d. Armco welded-pipe piles, with a wall thickness of 0.172 in., filled with concrete after driving. The Armco pipe pile is a spirally wound and welded tube, with the helical seam continuously welded by the submerged melt process.

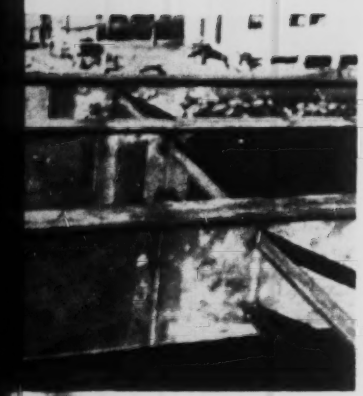
Design of the structure was such that piles of either 40 or 50-ton capacity could be used in the final structure. This was necessary in view of the fact that test piles were to be driven and tested by the contractor immediately before start of construction. Seven test piles were driven at approximately 200-ft intervals with a Vulcan No. 1 single-acting steam hammer employing a Koehring 601 crane with swinging leads, and were tested in accordance with the 1949 AASHO Standard Specifications for Highway Bridges. All piles were furnished with a flat plate point of ¾-in. thickness and 13½-in. dia, welded to the bottom. Immediately after driving, the piles were filled with concrete. The piles were tested by jacking against reinforced concrete weights with two 100-ton Watson Stillman jacks interconnected. Each pile was loaded in increments up to 80 tons, then unloaded; loaded up to 100 tons, and then unloaded again. Removal of the load was made to check compliance with the AASHO specifications, that the net settlement after rebound should not be greater than ¼ in. after twice the design load had been applied to the structure in accordance with those specifications.

Blows per foot ranged from 50 to 200, and all piles except one indicated a safe load of 50 tons. The one pile that did not test out at 50 tons required 100 blows per ft in the last foot, and indicated from the rebound that a design load of +40 tons would be satisfactory. Since this pile was representative of the yard area of the structure, where the heavy piers and loads and most of the piles were located, it was decided to use 40-ton piles throughout the structure.

Structural Studies Made

The function of the North Galvez Overpass is to carry two 14-ft lanes of vehicular traffic and one 5-ft pedestrian sidewalk over the Press Street yard, all in accordance with design requirements of the 1949 specifications of the AASHO for an H20-S16-44 loading. Furthermore, the track layout of the Press Street yard predetermines the location and orientation of the six piers in it. Piers 11, 12, 13, 14, 15, and 16 (Fig. 1). In addition, the location of bents 5 and 22 was also predetermined by the requirements of conditions at the site. With this information, the problem was to determine the most economic steel framing and type of construction to use.

The first consideration was to ascertain the most economical spacing of the intermediate piers, immediately adjacent to the Press Street yard, between bents 5 and 11 and 16 and 22. After considering the cost of both steel stringers and intermediate piers, and the requirement that St. Ferdinand and Montegut Streets be kept open for traffic, it was decided that the distance of approximately 360 ft could be most economically divided into six spans of about 63 ft.



Completed butt welds in floor stringers adjacent to structural T-beams for diaphragms indicate simplicity of design. T-beams are encased in concrete diaphragms.

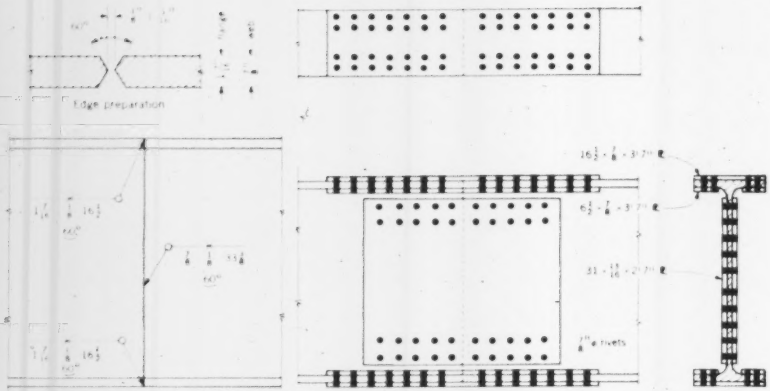


FIG. 4. Welded and riveted butt splices are compared. A 36-in. WF 260-lb beam (left, above) required 9.0 lb of weld metal per splice. Plates and rivets required for splicing 36-in. WF 280-lb beam (right, above) weigh 1,278 lb per splice. Welded splices for bridge saved 29 tons of joint material.

Both the east and west approaches, up to the yard area, were made identical and opposite hand.

Five design studies were made. Design A (shown in Fig. 3), which was adopted, and Designs B, C, D and E.

1. Design A was a fully continuous welded design with a riveted alternate. For the welded design 6,594 tons of structural carbon steel were required, and for the riveted design 6,744 tons were required. These figures include the weight of the beams themselves but not the weight of the connecting materials, which is considerable for the riveted design. The main difference between the welded and riveted designs is that the three yard spans require a 36 WF 280-lb beam if riveted, and a 36 WF 260-lb beam if welded. The difference of 1.6 tons is increased further if rivets are used because necessary connecting plates amount to a considerable tonnage. Use of lighter suspended span units in both the welded and riveted designs was considered but was discarded when the saving was found to be only 22 tons, which probably would be offset by the increased fabrication difficulties involved in butt welding beams of two different sizes in the field. In this design a constant depth of floor system is maintained, which results in a structure pleasing to the eye.

2. Design B was a riveted silicon design with cantilever suspended span approaches and simple beams over the five yard spans. It required 571.83 tons of silicon steel.

3. Design C was a riveted silicon design with cantilever suspended span approaches and simple beams over the three long spans in the railroad yard. It required 547.17 tons of silicon steel for the beams only.

4. Design D was a welded carbon design with cantilever suspended-span design throughout and a butt welded splice in the yard span as the length of the beam is well over 100 ft. A total of 592.38 tons was required for this design.

5. Design E required 407 tons of carbon steel and 247 tons of silicon steel. A saving of 22 tons was possible with substitution of 36 WF 150-lb beams for the 36 WF 182-lb beams in the suspended portion of the continuous units.

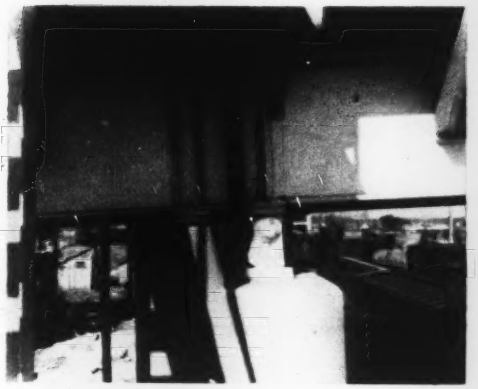
A major problem in all designs was the 81-ft yard spans. In the case of carbon steel, the use of simple beams for this span was uneconomical and inefficient owing to the AASHO requirements for depth ratios. Specifications require that the ratio of depth to span should be $\frac{1}{20}$, or in this instance, a depth of 45 in., which is considerably over the 36-in. depth of the largest beam rolled.

Considering the increased flexibility and fabrication costs of silicon steel as compared with structural carbon steel, the great difficulty of welding silicon steel, and the fact that vibration of the entire structure was expected because of vibration of the ground in the area of the railroad yard from train operations, the welded continuous structural carbon steel design shown in Fig. 3 was adopted. Accordingly, final design drawings were made for the welded continuous design and for a fully riveted continuous design in order to obtain good competitive bids.

Welded Design Yields Savings

Other basic differences in the details of design include the following. Comparison of the riveted butt splice with the welded butt splice reveals a remarkable difference in the amount of metal necessary to make the splice over and above the beam itself. For the riveted splice, rivets and plates weighing 791 lb were required. In direct contrast to this, the amount of deposited weld metal required to make a welded butt splice of the same beam is 5.70 lb, which includes 2.02 ft of $\frac{13}{16}$-in. double V-groove weld and 2.83 ft of $\frac{3}{4}$-in. double V-groove weld.

A riveted splice for a 36 WF 280-lb beam, shown in Fig. 4, required 1,278 lb of metal, including the rivets, to make one riveted splice. To make a welded splice for the same beam, 8.96 lb of deposited weld metal were required, including 2.75 ft of $\frac{17}{16}$-in. double V-groove weld and 2.78 ft of $\frac{7}{8}$-in. double V-groove weld.



Cast-steel rockers and fixed bearing plates were installed to permit unrestrained thermal movement in continuous spans. For shorter 63-ft spans, segmental rollers, machined from 6-in. billets, were used.

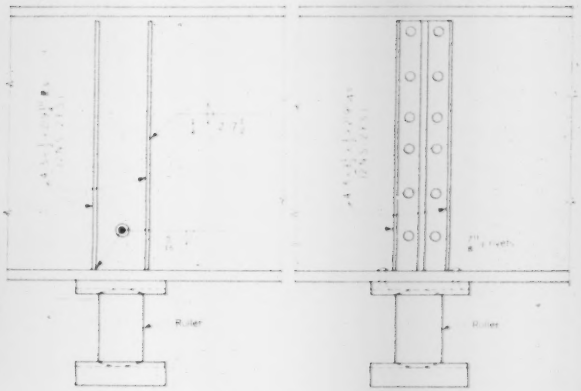


FIG. 5. Stiffeners were attached to web of beam at points of support. Welded design required 94.5 lb of plates and weld metal against 160 lb of plates and rivets in riveted design. Total difference was 59 tons.

To make all the riveted splices, 58,030 lb of material were required, including plates and 12,060 rivets. To make the welded butt splices, a total of 115 lb of deposited weld metal was required. In other words, 29 tons of extra material were required to make the riveted splices.

Stiffeners were required at points of support in both the riveted and welded designs. In the case of the riveted 36 WF 182-lb beam, four 5 × 3½ in. angles were required at each point of support, with twelve ⅞-in. rivets used to secure the angles to the web. From Fig. 5 it is seen that 9.5 lb of rivet material and 149.7 lb of angle material, giving a total of 159.2 lb of steel, were required.

In the case of the welded design, four 5 × ½ in. plates were used at each point of support, requiring a total of 115 lb of deposited weld metal and 94.2 lb of plate metal, a total of 95.4 lb per support. This is 63.9 lb, or 40 percent less metal than the riveted.

In Fig. 5 both the welded and the riveted base plates are shown. The same general details are used except that countersunk rivets are substituted for welds in the case of the intermediate spans, and 7⅞-in. round turned bolts are substituted for welds in the case of the yard spans. There is not much difference in the number of pounds of metal required to accomplish the desired results in either case. The main difference is that no holes need be drilled in the flanges of the welded WF beam, with considerable saving in shop handling, fabrication and weight of section.

Diaphragms Stiffen Structure

Diaphragms at an approximate spacing of 14 ft were used to stiffen the structure, to distribute the wheel loads to the six stringers, and to align the stringers during construction. Approximately 24.35 tons of riveted and 17.95 tons of welded material were required for the diaphragms. It should be pointed out that the design stress in the welded structure was set at approximately 60 percent of the nominal tension stress of 18,000 psi to allow for fatigue, whereas the stress in the riveted design was set at the full 18,000 psi. Even with this disadvantage, the welded tonnage of diaphragm material was about 26 percent less than the riveted. Welded diaphragms are inherently more rigid than the riveted, since there is a more direct transfer of tensile stress through the lower member.

To permit unrestrained expansion and contraction in the continuous span, rollers and rockers were used. For the lighter 63-ft spans, 84 segmental rollers, machined from 6-in. billets, were employed and cast-steel rockers were used in the heavier 81-ft span.

For the fixed ends, plates were used for the 63-ft, and steel castings for the 81-ft spans. Rotation was provided for in the case of the plates by rounding the face of the lower plate, and in the case of the steel casting by a 4-in. pin.

The total quantity of steel required for the riveted design was 805 tons, and for the welded design 746 tons, or a difference of 59 tons. Of this difference, only 15 tons were saved in the beam weight due to riveting holes, while the remaining 44 tons were saved in splice material. It should be pointed out that no temporary clips were welded to the structural members for aligning purposes.

A feature of the welded design was the fact that specifications and design permitted delivery of the steel directly from the rolling mill to the site, as no shop holes were required in the beams, and preparation of edges for welding was permitted by milling or chipping, or by flame cutting with portable mechanically guided cutting torches.

Fatigue Considerations in Welds

With butt welds made at the approximate quarter points of spans, the problem of fatigue was practically eliminated. Even though there was a slight reversal of stress at these points, the magnitudes were so small that the required effective weld areas were much less than the actual areas needed to safely with-

stand a minimum of 600,000 repetitions of loading, according to the welding specification of the American Welding Society. Stresses were computed to range from 5,000 ± psi in tension to 5,000 ± psi in compression in the flanges at splice points during the passage of live load.

It was felt that an extremely severe fatigue consideration was in the butt welding of the structural tees in the diaphragms, inasmuch as these would be subjected to a stress of a more vibratory nature. Accordingly a stress of approximately 10,000 psi was judged to be appropriate and well within the specification allowance for a stress change without reversal. In addition to butt welding the T beams to the webs of the beams, a $\frac{3}{16}$ in. fillet weld was specified around the outline of the T beam, so that the stress path might be smoothed by the elimination of reentrant corners.

Simple Erection Procedure

Erection of the steel by the Virginia Bridge Co. was efficient. Cantilever units were placed in position by a Browning 20-ton mobile crane assisted by a Koehring 401. The suspended units were then dropped in place and held in position by a temporary bolted rig, and welded. Diaphragms were then welded in position. Jigs for the butt welds were removed as soon as webs were welded with the first pass.

Six certified welders operated constantly, four of them making butt welds and two working on the diaphragms. Electrodes were of Classification No. E6010. Six 300-amp-hr welding machines were in use. Extension bars required by the specifications were used on the sides of all butt welded flanges. They were burned off, and the flange edges were made smooth by grinding. In making butt welds, webs were aligned first, and in some instances it was found, owing to rolling mill tolerances, that the flanges were shifted laterally with respect to their webs up to $\frac{1}{2}$ in. In this case a smooth transition was obtained by burning off and grinding the protruding edges for a distance of several inches.

Cambering and End Mitering

Providing the proper cambering and end mitering for the continuous beams in the vertical curve region required considerable thought, because the curve is parabolic with a rise of 4.50 ft in 359.94 ft. The splice points were determined from consideration of the maximum length for transportation by railroad and the fact that splices were located at the quarter points. A length of 100 ft was therefore set as the maximum.

With the splice points thus determined, the amount of camber required for each length of beam was determined on the assumption that the cambered beam would have the shape of a parabola. With this assumption, the elevation of the steel and the amount of end mitering required to get the abutting splice ends of the beams aligned for good welding were determined. It was essential to miter the ends slightly so that the root openings for butt welding were not less than $\frac{1}{16}$ in. and not greater than $\frac{3}{16}$ in. Camber on the 36 WF 260 beams amounted to $1\frac{1}{4}$ in. on the 100-ft lengths.

Measured elevations on the tops of the steel stringers at approximate 14-ft intervals varied not more than $\pm\frac{1}{4}$ in. from the computed elevations, with due allowance for dead-load deflection and cambering. Root openings also were carefully checked and found to be within the prescribed tolerance of $\pm\frac{1}{16}$ in.

Bids Lower on Welded Structure

Bids on construction of the overpass and rearrangement of utilities were opened January 16, 1950, in New Orleans, with seven contractors submitting bids on the riveted base proposal and on the welded alternate.

The low bidder was R. P. Farnsworth & Co., Inc., which submitted a base proposal on the riveted of $613,177 and an alternate proposal of $599,258 on the welded, or a difference of $13,919.

The average deduction for the welded alternate was $13,574, with values ranging from $11,100 to $15,000.

Henry Shepard was superintendent of construction for R. P. Farnsworth & Co.; Charles E. Cassagne, Jr., represented the New Orleans Terminal Board; E. S. Birkenwald, M. ASCE, Engineer of Bridges for the Southern Railway System, represented the railroads; the writer was in charge of design of the structure for Fromherz Engineers; Harold A. Pihe was resident engineer; and Prof. John K. Mayer, of Tulane University, was soil consultant.

(This article is based on a paper presented by the author during the New Orleans Convention before a session of the Structural Division, presided over by George E. Brandow, of the Division's Executive Committee.)

Six stringers equispaced and identical emphasize simplicity and economy of repetitive design.

HUGH L. DRYDEN

Director, National Advisory Committee for Aeronautics, Washington, D.C.

Fluid mechanics supports tasks of civil engineering

It is characteristic of the growing complexity of our technology that every branch of engineering is supported by innumerable specialized groups engaged in applied and basic science. Conversely, nearly every basic physical science finds application in nearly every engineering field. Such interlacing channels of influence present many opportunities for fruitful transfers of experience, and it is the business of professional societies to provide opportunities for and to stimulate this exchange.

Civil engineering problems dependent on a knowledge of fluid mechanics may be listed as wind effects on buildings, bridges, chimneys, and other structures; flow of water in open channels, in conduits, and in porous materials; transport and deposit of silt; erosion of river beds; tidal and flood waves. The traditional attack of the civil engineer on these problems has been the codification of past experience in empirical formulas which have the great merit of accurately representing past experience and the great disadvantage of providing no basis for extrapolation to new experience. Empirical methods encourage extreme conservatism and retard rapid development.

Modern progress in fluid mechanics is associated with the development of the airplane, and the history of aeronautical progress illustrates the great power of rational analysis in terms of theories based on experimental measurements of the behavior of real fluids.

Aerodynamics received its greatest impetus from the development almost simultaneously of a theoretical and an experimental tool. The theoretical tool is the theory of dynamic similarity, which establishes a basis for model experiments and for inferring from data in experiments for which one primary quantity (for example, speed) is varied, the results that would be obtained in quite different experiments in which another primary quantity (for example, density) is varied.

The experimental tool is the wind tunnel, where research depends on the Newtonian concept of relativity, by virtue of which the forces and relative flow are the same whether the object moves through a fluid at rest, or whether the fluid moves at the same relative speed past the stationary object. Because the channels of communication between designers and scientists are excellent, technical needs influence the direction of aeronautical research, and the results of aeronautical research influence technical development.

Some years ago I applied wind tunnel techniques to the civil engineer's problem of wind pressure on structures; but found that even the concepts of velocity field and pressure field were not then familiar to civil engineers. The civil engineering profession still has need of a coordinated program of measurements on actual structures and on models in a wind tunnel to establish its confidence in this method of determining the loads to be applied to future important structures.

The civil engineer has had one informative experience with the destructive phenomena of flutter under aerodynamic forces, and the wind tunnel has been used to work out a satisfactory solution for the new bridge across Tacoma Narrows. In another important bridge project in England, wind-tunnel studies are under way to verify the design.

The principal concern of civil engineers with fluid mechanics lies in its applications in hydraulics. The setting of sharp boundaries between the work of the Hydraulics Division and the Engineering Mechanics Division is to be discouraged; the more crossing the better. In general, it should be the responsibility of the Engineering Mechanics Division to stimulate the rapid development of a body of scientific knowledge, specifically to develop theories adequately supported by experimental data in those areas which support the practical engineering design work in progress. Its interests must cover the shorter-range problems whose importance is readily appreciated by civil engineers and whose solution gives immediate returns, but must also include the longer-range problems which lead to greater understanding and larger accomplishments in the future.

There is some danger of an unbalanced effort between theoretical and experimental work. Pencil and paper are so much cheaper than wind tunnels or hydraulic flumes. Yet it has been demonstrated over and over again that progress comes from the close mutual interaction of theory and experiment.

Experimental techniques in the study of hydrodynamics present many challenging problems. Aerodynamicists and hydrodynamicists have much to learn from each other, and each needs to interest physicists and instrument research groups in their problems of measurement. Progress in measurement techniques and improved instrumentation have proved to be the key to advances in aerodynamics.

I cannot emphasize too strongly that the meteoric advance in aerodynamics does not satisfy the needs of civil engineering. The great advances of the last few years have dealt largely with laminar flow in boundary layers, initial stages of transition to turbulent flow, and the theory of non-viscous compressible and incompressible fluids. Progress in the basic understanding of the flow of incompressible and compressible fluids of small viscosity has been very great. Progress in fully developed turbulent flow processes has been at a more moderate rate, and our present methods are still semi-empirical in character. Nearly all the problems of practical hydraulics involve turbulent flow. I believe the key to the rather late interest of civil engineering in a rational science of fluid mechanics is to be found in this fact.

Certainly the civil engineer should support a campaign to understand the key processes inherent in the operation of all hydraulic works, natural and man made.

(This is an abstract of Dr. Dryden's address at the dedication of the Engineering Mechanics Division, presided over by Nathan M. Newmark, at the ASCE Annual Convention in New York.)

Wind pressure on elementary building forms evaluated by model tests

Among the least understood of the forces dealt with by the structural engineer is wind pressure. Evidence of this fact is the common design practice of using an arbitrarily chosen uniform pressure intensity over the projected area of a structure or member. Students of fluid motion are well aware of the great variation in pressure that results from the flow of air around any object, and they realize that knowledge of the actual pressure distribution around buildings would permit more economical yet safer designs. Although tests have been conducted by many investigators in the past fifty years, the technical literature contains no comprehensive experimental data that would permit interpolation for wind loads at particular points on buildings of any desired form. This situation is partially due to the great divergence in building forms, but in large measure it has resulted from the failure of structural engineers as a whole to appreciate the need for such information.

In 1946 a systematic series of tests on three dimensional building models was begun at the University of Iowa for a graduate thesis in the Department of Mechanics and Hydraulics. The scope of these tests was later broadened as a project of the Iowa Institute of Hydraulic Research, sponsored by the Office of Naval Research.

Theoretical Considerations

The variation in pressure around a building depends on the local variations in velocity in accordance with the fundamental energy relationship,

$$p - p_0 = \frac{\rho v_0^2}{2} - \frac{\rho v^2}{2}$$

in which p and v are the pressure intensity and velocity at any point, and the subscript "$_0$" indicates a point at some distance from the building in the undisturbed air stream. The density ρ varies from 0.0027 slugs per ft^3 at 0 deg F to 0.0022 slug per ft^3 at 100 deg F.

If the difference Δp between the pressure at any point and that in the undisturbed flow is divided by $(\rho v_0^2)/2$, the expression takes the form,

$$\frac{\Delta p}{(\rho v_0^2)/2} = 1 - \left(\frac{v}{v_0}\right)^2$$

from which the effect of a local change in the velocity is at once apparent. The pressure parameter has its maximum positive value of unity at a point of stagnation, whereas its negative value has no definite limit. The parameter

$$\frac{\Delta p}{(\rho v_0^2)/2}$$

is essentially a pressure coefficient and will hereafter be referred to as C_p.

The velocity variation is uniquely determined by the flow pattern around the building. This pattern depends on the geometrical configuration of the building, the velocity distribution of the wind, and the viscosity of the air. Although each of these factors must generally be considered, it can be demonstrated that the geometry is nearly always the dominant one. Reduction of wind velocity near the ground has the primary effect of causing smaller pressure variations than would otherwise occur. Consequently, tests made in an air stream of constant velocity will indicate the maximum pressure variation to be expected. Viscosity likewise influences the flow pattern in some cases, but the artificial roughening of curved models or the sharp discontinuities that usually exist serve to produce a constant flow pattern which is practically independent of viscous effects.

Therefore it may be assumed that the values of C_p obtained on models tested in the wind tunnel and displaying flow patterns of constant form, with fixed points of separation, may be used to predict actual pressures on prototype structures.

Low-Velocity Wind Tunnel Tests

The tests were performed in a low-velocity wind tunnel having a test section 6 ft wide and 4 ft high. Models were mounted on a thin platform 6 in. above the floor in a region of constant velocity. The models were made of $\frac{1}{4}$-in. plastic plate and were formed into the series of unit combinations shown in Fig. 1. Piezometer openings $\frac{1}{16}$ in. in diameter were closely spaced in regions where high velocity gradients were expected and were provided with nipples for tubing connections. The basic forms tested were the hangar or semi-cylinder, the rectangular vertical wall, and the block-type gabled building. The rectangular block-type buildings consisted of 4 × 4 × 2-in blocks in combination with others of that size or of 4 × 8 × 2-in. size to form buildings with length-width ratios of 1, 2, and 4 in combination with height-width ratios of $\frac{1}{2}$, 1, and $\frac{1}{2}$. In addition, each of these combinations had gable roofs whose inclinations to the horizontal ranged from 15 to 45 deg.

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Each of the three basic forms was tested at several orientations with the wind, the angle α being measured between the end wall and the wind vector, as indicated in Fig. 1. There were 16 tests on hangar forms, 21 on rectangular walls, and 108 on block forms. In addition, exploratory tests were made to determine the effect of spacing on the pressures over the facing walls of identical flat-roofed buildings with parallel orientation.

Pressures were measured with a delicate Wahlen differential gage which was sensitive to 0.000003 psi. The reference value $(\rho v_0^2)/2$ was measured by means of a stagnation tube and a floor piezometer near the model platform. Pressures on the models were read relative to the same floor piezometer. The ratio of these readings gave the value of C_p. The probable error in the pressure determinations was less than 2 percent.

Test results were plotted on the developed surfaces of the models and lines drawn through points having equal values of C_p to yield patterns similar to those in Fig. 2. Integration of the pressure patterns yielded the total force acting on any surface. Values of the parameter C_p are directly useful, as previously indicated, to determine the actual pressure distribution on a similar structure at any desired wind velocity. Such diagrams for each of the 150-odd test conditions are presented in the complete report referred to at the end of this article.

Force Intensity Varies Widely

The pressure patterns indicate the wide variation of force intensity over the surface of a building and permit the evaluation of actual magnitudes at any point. They do not, however, provide a ready means of comparing the effects of varying geometrical configuration. For this purpose, pressure profiles at significant sections were plotted for windward and leeward wall and roof surfaces.

A typical summary of pressure variation on a hangar roof is shown in Fig. 3. It is apparent that negative pressures over the central section of the hangar roof are significantly increased as the length of the building becomes greater. See curve (b). Because of the lightness of hangar-type structures, lift and drag coefficients were also determined for use in the formulas,

$$F_L = C_L LD \frac{\rho v_0^2}{2}$$

$$F_N = C_N LD \frac{\rho v_0^2}{2}$$

$$F_A = C_A \pi D^2 \frac{\rho v_0^2}{16}$$

in which F_L is the lifting force; F_N and F_A the horizontal components of the drag in the normal and axial directions, respectively; C_L, C_N, and C_A are lift and drag coefficients; and L and D are the length and diameter of the structures. The maximum C_L value of 0.55 occurs on the longer models at wind angles of 30 deg. The coefficient C_N rises to 0.84 at the same wind angle, whereas the coefficient C_A reaches 1.18 on the shortest model with the wind directed toward the end face. The greatest vectorial combination of the drag coefficients is 1.23.

Pressure patterns on the vertical wall forms disclose that the geometric shape has a pronounced effect on pressure intensity, as illustrated in Fig. 4. The pressure patterns were integrated to determine the total force acting on the windward

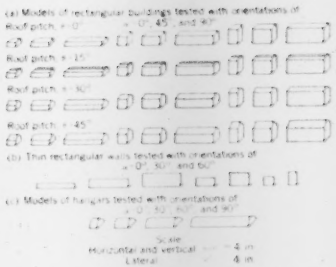

(a) Models of rectangular buildings tested with orientations of
Roof pitch, i = 0°
Roof pitch, i = 15°
Roof pitch, i = 30°
Roof pitch, i = 45°
(b) Thin rectangular walls tested with orientations of
(c) Models of hangars tested with orientations of
Scale
Horizontal and vertical
Lateral
4 in.
4 in.

FIG. 1. Schedule of model arrangements shows shapes, proportions and wind directions at which models were tested. There were therefore 108 tests on block-type buildings, 21 tests on walls, and 16 tests on hangars.

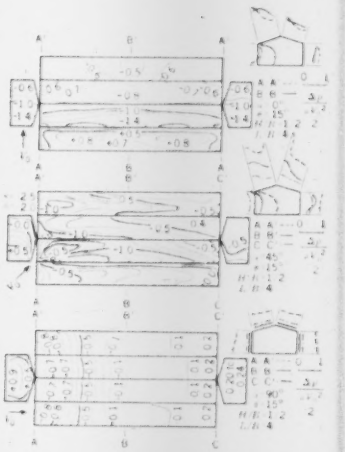
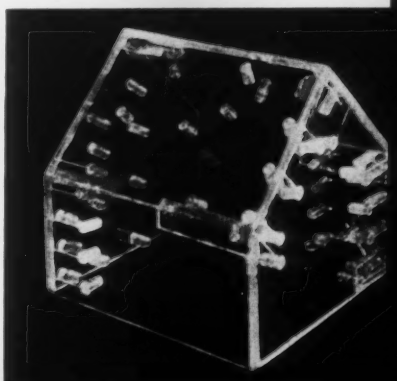


FIG. 2. Typical pressure patterns on block-type model are shown for three wind directions. Occurrence of negative pressure on all faces of building should be noted. Pressure profiles at right indicate variation at end and center sections.



Models of buildings were made from $\frac{1}{8}$-in. plastic sheet and equipped with $\frac{1}{16}$-in. piezometers closely spaced at points where velocity gradients were high. The model shown was 4 × 4 in. in plan, with a 45-deg roof, the smallest size tested.

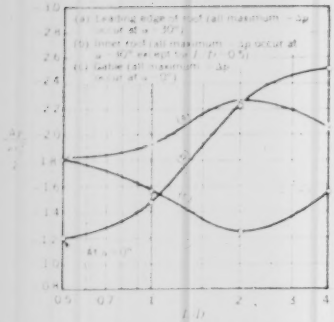


FIG. 3. Pressure intensities on a hangar vary with relative length of structure. Maximum pressure intensities are shown (a) at leading edge of roof when wind is at an angle, (b) at section where greatest vacuums occur, and (c) at end gable with a normal wind.

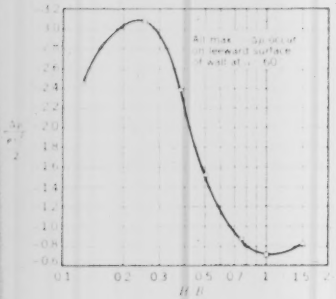


FIG. 4. Pressure intensity varies with proportions of wall. Largest vacuums occur on back side of wall with wind direction 60 deg from normal.

and leeward faces of the walls, and the position of the pressure centroid was located relative to the vertical and horizontal center lines of the wall, as shown in Fig. 5. Apparent from this figure is the considerable mismatching of the centers on opposite sides of the walls. This indicates the presence of a decided torque on the wall supports. The drag coefficients on the windward and leeward surfaces are of the same order of magnitude, typical values being 0.75 and −0.55. In combination, the total coefficient of drag ranged from 1.2 to 1.4.

The block type structures had a greater variation in form than either the hangars or the walls and consequently were subject to greater pressure variations. The pressure profiles near the ends and at the centers of the buildings were compared with respect to both local pressure intensity and average pressure intensity over the section. Except for cases of symmetrical wind loads, each building face displayed a different pressure distribution. In general, the windward face was under positive pressure, approaching the stagnation value of $(\rho v_0^2)/2$ near the center of the wall and decreasing to values below atmospheric pressure at the exposed edges. The roof was generally subject to negative pressure on the windward slope if its inclination was small, and was invariably subject to negative pressure on the lee slope. The leeward and end walls, being in the eddy formed by separation at the leading edges of the building, were in a region of rather uniform negative pressure. As the wind direction varied, these general conditions were modified.

Variations in the geometry of the buildings do not cause large pressure variations in so far as building proportion is concerned (Fig. 6). Roof angle, however, is of considerable significance (Fig. 7). The variation of average positive pressure ranges from 0.75 to 0.95 of the stagnation value in all models, there being little relation to their proportions other than a slight tendency toward greater values at higher roof inclinations. Average negative pressures over sections near the corners showed even less effect of building proportions, but the rather large negative values on the windward face should be noted. Many engineers may find it hard to reconcile the presence of both positive and negative pressures on the windward face of a building, but the fact that both are present is well substantiated.

The angle of inclination has a major effect on pressure distribution over the roof (Figs. 7 and 8). The effect of roof inclination overshadows that of building proportion, although in general the long, high buildings were found to be subject to considerably higher negative pressures than the short, low forms.

The effect of roof inclination is even more pronounced if local pressure intensities are compared. The greatest negative pressure, regardless of wind direction, was plotted against the geometrical characteristics of the building (Fig. 9). The large suctions that developed at roof angles of less than 30 deg, at the windward corner in a quartering wind, are truly surprising. Under these conditions, two vortices form over the roof and produce extremely low pressures. The peak value of −7.4, combined with stagnation conditions (+1.0) inside the building, would correspond to

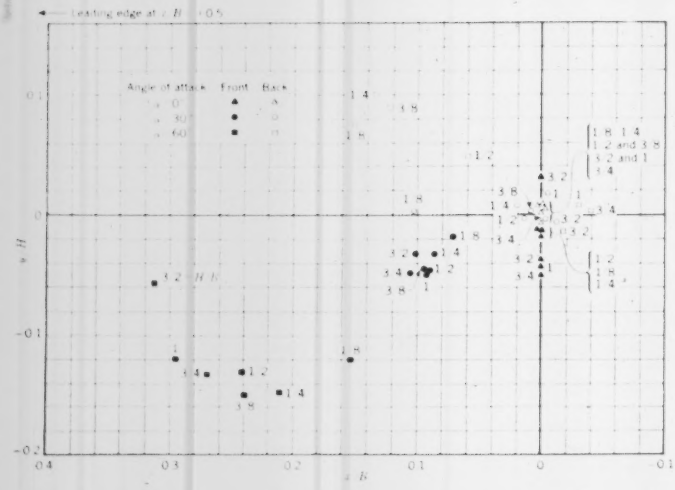


FIG. 5. Centers of pressure on wall faces are not opposite except in normal wind. Hence, an appreciable twist is exerted on wall supports. Suction on back of wall is generally only 30 percent less than thrust on front side.

an uplift of 78 psf in a 60-mph wind, a value well in excess of usual design values.

The lee roof, lee wall, and end walls are subject to rather uniform underpressures averaging about 0.6 $(\rho v_0^2)/2$. Although space does not permit the inclusion of summary curves, they are available in the original report.

Effect of Building Proximity

The last phase of the investigation dealt with the effect of building proximity. Since the number of tests required to establish the relations previously described was considerable, it was not feasible to investigate the effect of all the variables involved in a complete study of proximity effects. Only an exploratory series of tests was made to determine whether the presence of an adjacent building could increase the negative pressures measured on an isolated structure. Two identical flat-roofed buildings of equal width and height were placed side by side with their long sides parallel. Four lengths of buildings were tested at several different spacings and wind directions. For these particular buildings it was found that the greatest negative pressure intensities developed at the front edge of the passage between buildings and were approximately twice as large as the pressure at the same point on an isolated building when the spacing was about one-tenth that of the building width or height. Furthermore, the average suction on the facing walls was as much as three times that on a single building side wall. Because of the restriction of variables, the only conclusion reached was that the presence of an adjacent building may cause greater negative pressures on some areas of walls than would occur on the same walls were the building isolated. Particular arrangements should be studied in a wind tunnel to determine actual pressure distributions.

Example Shows Application

To indicate the use of the test results the following example is presented. Determine the wind loadings on a rectangular building 20 × 80 ft in plan and 10 ft high with a roof slope of 1:4 and bents on 20-ft centers. (See Fig. 10.) The roof slope of 1:4 is 14 deg, near enough to 15 deg to permit direct use of tests in a model having $\theta = 15$ deg, $L/B = 4$, and $H/B = 1/2$, the pressure contours of which are shown

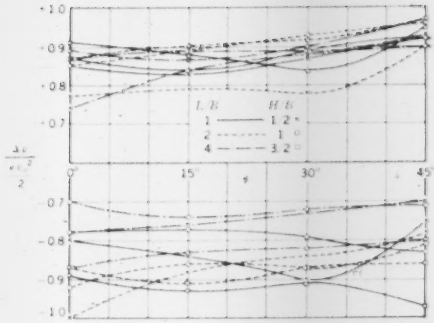


FIG. 6. Average pressure on front wall of rectangular building is positive near center of structure but negative at corners. Building proportions do not greatly affect front wall pressures.

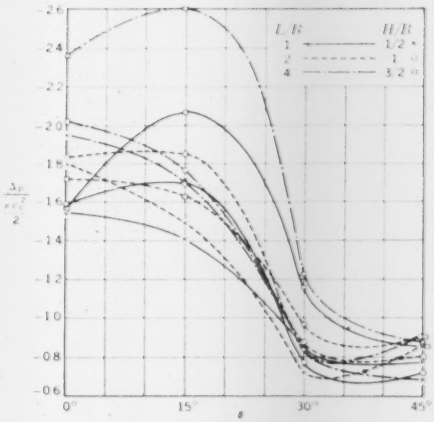


FIG. 7. Average negative pressures at worst sections of windward roof show decided effect of roof pitch. Greatest uplift occurs at leading edge of flat-roofed buildings or at ridge of steep roofs.

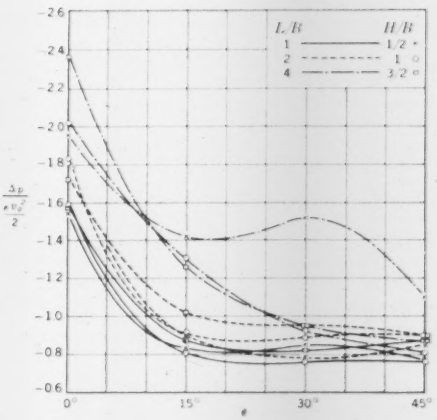


FIG. 8. Average negative pressure on transverse section of leeward roof is worst on flat-pitched roof and not greatly affected by building proportions.

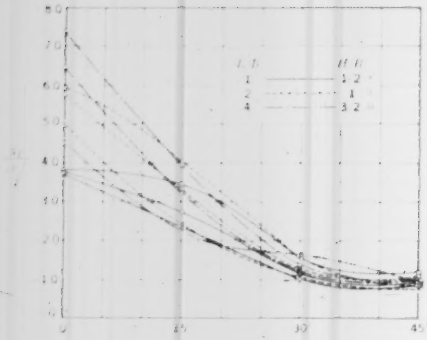


FIG. 9. Local pressure intensity on block building reaches extreme value in quartering wind. Roof pitch is significant below 30 deg.

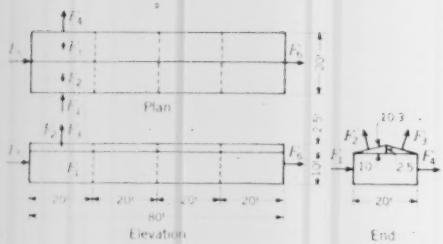


FIG. 10. Experimental coefficients are applied to 10 × 20 × 80-ft block building to determine wind forces.

in Fig. 2. A wind velocity of 100 mph (147 fps) is assumed.

Side thrust on a bent near the center of the building will be maximum when the wind angle $\alpha = 0$ or on an end bent when $\alpha = 45$ deg. The average pressure coefficient for the front wall is found from Fig. 6 to be 0.84. The force F_1 on a 10 × 20 ft panel will thus be

$$F_1 = 10 \times 20 \times 0.84 \times 0.0024 \times 147^2 \cdot 2 = 1{,}350 \text{ lb per panel}$$

Maximum negative forces on the roof surfaces can be estimated from Figs. 7 and 8 for the 45-deg wind condition. Mean coefficients of −1.7 and −1.4 are read. These indicate the following forces:

$$F_2 = 10.3 \times 20 \times -1.7 \times 0.0024 \times 147^2 \cdot 2 = -9{,}100 \text{ lb per panel}$$

$$F_3 = 10.3 \times 20 \times -1.4 \times 0.0024 \times 147^2 \cdot 2 = -7{,}500 \text{ lb per panel}$$

Similarly, the force on the leeward wall at an end bent is

$$F_4 = 10 \times 20 \times -0.9 \times 0.0024 \times 147^2 \cdot 2 = -4{,}700 \text{ lb per panel}$$

These forces would be somewhat different at different bents but probably the same framing would be used in order to make the construction uniform. The forces at any panel can be estimated by selecting coefficients from Fig. 2 and computing the total force in the manner illustrated above.

Longitudinal forces resulting from pressure on the ends of the building are based on an average pressure coefficient of 0.9 on one end and −0.2 on the other. The end areas are $(10 \times 20) + (10 \times 2.5) = 225$ sq ft.

$$F_5 = 225 \times 0.9 \times 0.0024 \times 147^2 \cdot 2 = 5{,}000 \text{ lb}$$

$$F_6 = 225 \times 0.2 \times 0.0024 \times 147^2 \cdot 2 = 1{,}100 \text{ lb}$$

The large wind forces on the roof are opposite in direction to the dead load and are therefore not likely to be critical. It should be noted that such formulas as the commonly used Duchemin formula indicate the presence of downward forces which are added to the dead load, thereby causing roof supports to be considerably overdesigned.

Fastenings for wall and roof cover should be designed to resist the outward force caused by negative pressure outside the building accompanied by positive pressure inside due to the likelihood of an opening on the windward face of the building. Inspection of Fig. 2 reveals the possibility of large vacuums near the ends and at the ridge of the roof, where the pressure coefficients range from −2.0 to −2.5. Elsewhere values vary from −1.0 to −1.5. If unity is added to these values to include the effect of stagnation pressure inside the building, it is apparent that a 100-mph wind may produce on the roof of this structure upward thrusts of from $2.0 \times 0.0024 \times 147^2 \cdot 2 = 52$ psf, to $3.5 \times 0.0024 \times 147^2 \cdot 2 = 90$ psf.

Outward forces are also exerted on the vertical walls, and average values are shown in Fig. 6, where a coefficient of 0.75 is indicated on the long side. This value may be used on all walls although nearly double this value may occur on particular areas, as shown in Fig. 2. If stagnation pressure inside is added, then it is seen that in a 100-mph wind the wall covering will be subjected to approximately

$$1.75 \times 0.0024 \times 147^2 \cdot 2 = 45 \text{ psf}.$$

The systematic series of pressure diagrams that have been described provide a means of selecting safe and economical design wind loads on simple building forms of three common types. The detailed effect of geometrical configuration on pressure intensities is illustrated, particularly the presence of large vacuums in zones of separation. Furthermore, the tests on proximity imply a decided influence of adjacent buildings and indicate the necessity of special model studies on complex building forms or arrangements. Since the test results were measured in a steady wind, they do not indicate the extreme values that would result from gusts.

All experimental studies on which the accompanying diagrams are based were conducted in the laboratories of the Iowa Institute of Hydraulic Research. The majority of the tests on block structures were made by N. Chien, Y. Feng, and H. J. Wang as a master's thesis under the direction of the writer. The remaining tests were made by Messrs. Wang and T. T. Siao as an Institute project under the direction of Prof. Hunter Rouse and sponsored by the Office of Naval Research. Copies of the complete report by Chien, Feng, Wang, and Siao, under the title, "Wind-Tunnel Studies of Pressure Distribution on Elementary Building Forms," are available from the Iowa Institute of Hydraulic Research at the cost of reproduction, $1.75 each.

Users of explosives are liable for all damage

LAW

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Explosives are intrinsically dangerous, and more than ordinary care is required in their transportation, storage and use. Generically, the term is broad, including gasoline and other petroleum products, mine dusts, special gases, black powder, nitroglycerine, dynamite, and the many types of military stores. While the law on all explosives is basically uniform, this article is concerned with dynamite and its associated detonators of electric exploders and blasting caps.

The continuing responsibility for explosives may be illustrated by the following situation. In a case that occurred 40 years ago, in Spokane, Wash., a contractor completed his work on a street construction project, was paid in full, and considered the job closed. While erecting a light pole a few months later, a power company discharged dynamite left by the contractor in a misfired hole. The contractor was held responsible for negligent use of dynamite in his original work. While it is true that city officials had fully accepted the work, they neither knew nor had grounds for suspecting that there might be unfired dynamite in the ground. The city had no responsibility for this hidden danger under the street.

The storage of explosives requires the exercise of extreme caution on the part of the contractor. Recent cases have held contractors responsible for injuries from percussion caps stored where children were known to play. Of course, the contractor's degree of responsibility would not extend to injuries suffered by a thief, or even by the average trespasser.

Excavation. Injuries may be caused by any of the following normal results of excavation and quarrying:

1. Sound, as in the old cases involving frightened horses, or the nerve-racking annoyance from the incessant booming of quarry explosions.
2. Flying debris, where excessive explosives or untied-down shots send rock hurtling onto public highways and private property.
3. Concussion and vibration, where structures are shattered or weakened by the shock of explosion.

Sound. Mere fright caused by unusual noise does not provide sufficient basis for legal action. This limitation is justified by the difficulty of proof, the imagination of the supersensitive, and the opportunity for plain fraud. In point is the frightening of a person or horse by the crack of an explosion or the shriek of a locomotive whistle. However, these disturbing sounds must not be the consequence of negligence, such as failure to give proper notice of blasting operations.

Statutes and ordinances are particularly strict in requiring that clear, definite warning must be given people whose lives or property may be in peril. Notices to those in the vicinity of quarries are not always sufficient, since incessant blasting may easily become a public or private nuisance, with the potential remedies of injunction or suit for money damages. In a case in point, merely notifying a power company that there would be blasting under their transmission line, did not absolve a contractor of his civil responsibility. In another case, the builder of a superhighway in California had to use extra care while blasting in spite of his notice.

Flying Debris. Injury from a hurling rock is real. The rock may make a bruise, draw blood, or even cause fatal injuries. Damage to property is equally evident. Where damage has been caused by flying debris, the cause and effect are easily discernible. The important issue is whether the injured plaintiff should carry the difficult burden of proving by a preponderance of evidence that the defendant was negligent. An excessively loaded charge would be a case in point since it would necessitate proof of the depth of the hole, the type of rock, its physical condition, and the quantity and composition of the explosive. The plaintiff would probably not know these details. In general, the statutes and ordinances, supported by the court decisions, assume that the existence of flying debris is the result of negligence. After all, the blaster is aware of the potentialities for danger in explosives and should therefore exercise an unusual degree of care.

Concussion and Vibration. When there is property damage due to the shock of a blast, recovery may be had either on the basis of negligence, of nuisance, or of absolute liability. There is a conflict on this point, with nine eastern states holding that recovery for damage due to concussion and vibration requires proof of negligent operation. This opinion, held by a minority of the states, appears to be founded on a New York railroad case of 1893, where a home owner sought a money judgment for the shattering of his home from the shocks of explosions. The heavy burden of proving that this excavation work was performed in a negligent manner was placed upon the home owner. The court stated that the railroad had the "right to adapt its own property to a lawful use, through means necessary, usual, and generally harmless." The court insisted on proof of negligent blasting because concussions and vibrations did not constitute a trespass. In other words, one could not see the concussion travel from the blast to the damaged house. Furthermore, this court held that the public interest necessitates a minimum of restrictions upon public improvements and construction projects. It should be noted that this opinion, held in the nine eastern states, has been materially narrowed down by statutes and decisions during the past 60 years. In other words, if there has been an injury from concussion, there probably was negligence.

In the future the majority of the states may follow the precedent set in a Connecticut case of the past year, where a contractor was civilly responsible for vibration damage to a nearby hotel. In its ruling, the court held that there was a real force which passed from the blast to the hotel and that a private hotel should not suffer personal damage for a public project.

Conclusion. An explosive is an instrumentality of known dangerous characteristics. When a contractor undertakes blasting operations under conditions where others are exposed to obvious or probable danger, he does so at his own peril. He is absolutely liable for the damages whether he was negligent or not.

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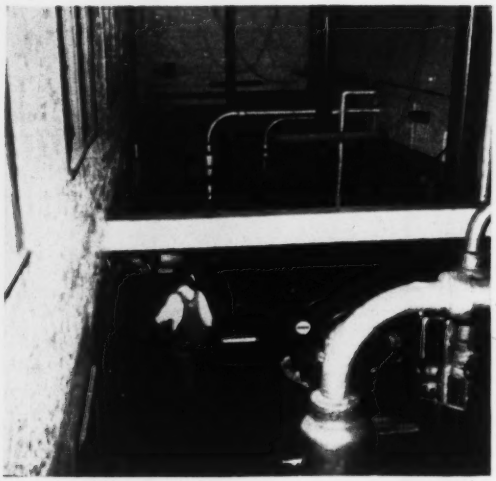


Steam-driven pumps of municipal water pumping plant in Miami, Fla., use steam from nearby refuse incinerator. About 80 percent of city's water supply is pumped by this means.

Can waste heat from refuse incinerators be employed

The idea of putting the heat from refuse incinerators to some good use has appealed to engineers and city planners since the first municipal incinerator was constructed. History records that virtually the first innovation following the development of satisfactory high-temperature incinerators was the installation of waste-heat boilers for reclaiming the heat.

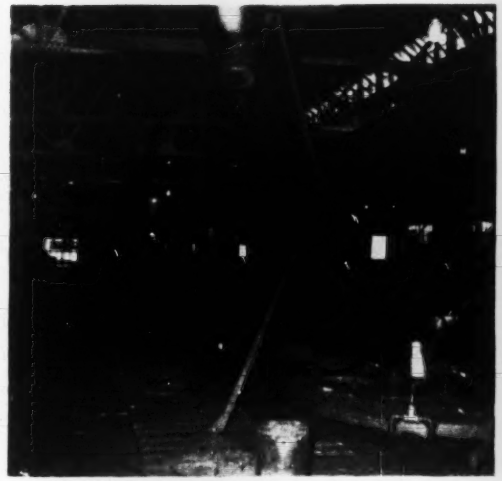
Initially the waste-heat boiler was placed in the primary chamber where it was exposed to the direct heat of the flames. The effect was that it absorbed the heat too rapidly, thereby cooling the volatile gases before they were completely burned and reducing the efficiency of burning. Subsequently the boiler was moved into the secondary chamber where the transfer of heat energy was more uniform and satisfactory.

Very early the British employed waste heat to produce steam for driving power units. Most frequently, this power was used in the processing of salvaged material, in particular to manufacture bricks from incinerator residue (clinker) and to prepare ashes, paper, and metals for salvage. In a few instances the heat was utilized to drive pumps for water works or sewage plants. In addition, incinerators were operated in conjunction with coal-fired power generating plants to run street cars and lighting systems. However, many electrical and mechanical engineers hesitated to tie the operations of electrical power production or water pumping to the relatively irregular power production of a municipal refuse incinerator. Since World War I, the heat energy available in British refuse has been so reduced that separation of the inert part has been required, making waste heat utilization an uneconomical venture.

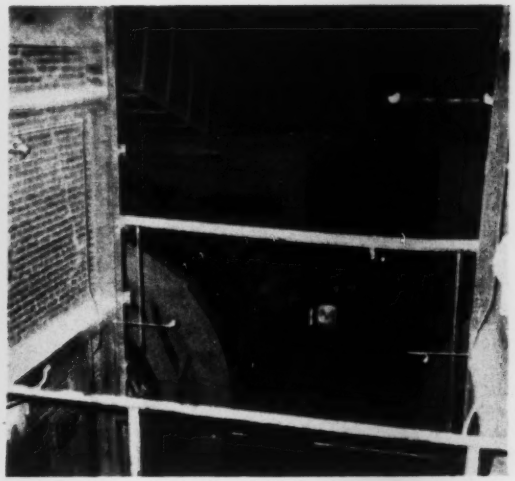
In the United States, high-temperature incinerators, with provisions for waste-heat utilization, initially followed British design. An exception, the relatively recent plant built in Atlanta, Ga., uses a rotary-kiln incinerator of Danish design. Here the refuse is used to produce steam for the low-pressure heating of public buildings in the city. Other uses of waste heat in the United States are listed in Table I.

Analyses of the operation of existing incinerators indicate the necessity for controlling the amounts of moisture and inert matter contained in the material burned in the primary chamber. In England inert fine material is separated out by mechanical shaking, while metals and glass are removed by hand sorting to further reduce the inert content. By the use of counter-current principles it is possible to predry the refuse before burning. This stabilizes the heat content and permits more uniform heat exchange. Variations in the heat energy of refuse are shown in Fig. 1.

The desirability of predrying refuse if waste heat is to be utilized, has been demonstrated at Atlanta, Ga., where predrying appears to aid in stabilizing the refuse. Presizing of combustible refuse by grinding, so as to achieve more uniform rates of combustion, has been tried in several installations but usually has proved too expensive and has not materially improved combustion. The significant factors affecting combustion of refuse are the amounts of moisture and inert matter present, rather than lack of homogeneity in the size of particles.



In refuse incinerator at Atlanta, Ga., waste heat is reclaimed through boiler tubes located in large combustion chambers at far end of rotary kilns.



Garbage reduction plant at Rochester, N. Y., uses steam from adjacent refuse incinerator for cooking and dehydration.

economically

One method used in America for utilizing heat from municipal incinerators has been to combine incineration with the reduction and salvage of garbage for stock feed and grease recovery. The reduction process requires large quantities of heat for cooking and dehydrating the garbage, and the salvage process is not adversely affected by the variation in the supply of heat from an incinerator as is the production of power. However, the economics of refuse disposal have changed so much over the years that the reduction of garbage is generally found to be uneconomical under present conditions.

Where an incinerator can be located close to a sewage treatment plant it may be possible to use the waste heat from the incinerator in drying the sewage sludge for use as fertilizer or in supplying the additional heat needed to incinerate the sludge. Well-designed sewage treatment plants providing separate sludge digestion will usually produce sufficient sludge gas (methane) to fill all, or most, of the power and heat requirements of the plant, but where the gas production is not sufficient a refuse incinera-

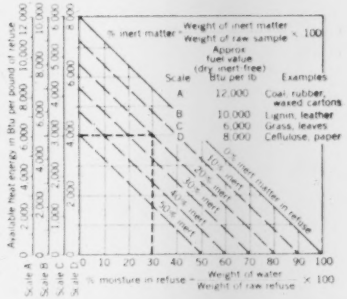

% inert matter = Weight of inert matter / Weight of raw sample × 100
Approx fuel value (dry, inert-free) Btu per lb
Scale
Examples
A 12,000 Coal, rubber, waxed cartons
B 10,000 Lignin, leather
C 6,000 Grass, leaves
D 8,000 Cellulose, paper
Available heat energy in Btu per pound of refuse
% moisture in refuse = Weight of water / Weight of raw refuse × 100
10% inert matter in refuse
20% inert
30% inert
40% inert
50% inert

FIG. 1. Available heat energy in a specific refuse can be read from graph. For example, assume a refuse with dry, inert-free fuel value of 6,000 Btu per lb (Scale C). Sample contains 20 percent inert matter and 30 percent moisture. From graph, available heat energy is read on Scale C as 3,000 Btu per lb.

TABLE I. Uses of Waste Heat from Refuse Incineration

Location	Use of Waste Heat*
Pasadena, Calif.	Produces boiler feed water for adjacent municipal power company
New London, Conn.	Heats sludge digesters
Miami, Fla.	Pumps municipal water supply
Atlanta, Ga.	Produces steam sold to power company which uses it to heat buildings
Holyoke, Mass.	Heats water for local heating; use in heating sludge tanks and burning sludge is planned
Worcester, Mass.	Heats garage
Irvington, N. J.	Heats garage
Tenafly, N. J.	Dries sewage sludge
Rochester, N. Y.	Produces steam for use in adjacent garbage reduction plant
Cincinnati, Ohio	Heat from Central Plant is used in adjacent municipal buildings; two newer incinerators do not use waste heat
Providence, R. I.	Generates electricity for use in sewage plant
Fredericksburg, Va.	Produces hot water used to wash city-owned garbage cans
Spokane, Wash.	Heats adjacent municipal buildings
Milwaukee, Wis.	1909 plant produces power for pumping water; no heat utilization in 1930 plant or planned in proposed plant

* Information derived from survey of known installations conducted by the writers for the Sanitary Engineering Research Project, University of California, April 1951.

tor might conveniently fill the need. Savings in power and heat must be balanced against possible increases in hauling costs when an incinerator is located at a sewage treatment plant instead of centrally with respect to the refuse collection area.

Strategic location of incinerators may enable them to serve as power sources for the pumping of municipal water supplies if the pumped water is stored before distribution. In pumping to storage, variations in power production do not affect the distribution system. Uses such as this, where large fluctuations in power production can be absorbed, offer the most reasonable utilization of waste heat.

Adverse Factors Considered

With few exceptions, engineering studies made in recent years have indicated that the utilization of waste heat from incinerators is not desirable. The reasons commonly given are:

1. Unsuitability of waste heat for power applications because of fluctuations in heat supply.

2. The necessity of maintaining continuous 24-hour operation to supply a firm, continuous demand. This usually necessitates duplication of equipment to provide for accidental breakdown or other unforeseeable occurrences.

3. The impracticability of locating incinerators near points where the waste heat can be utilized, or the excessive costs involved in transmitting heat or power over long distances.

4. A natural reluctance on the part of officials to experiment with public funds in trying out new ideas.

5. The long record of failure of such systems.

The city of St. Louis, Mo., now has under consideration a plan for the construction of incinerators to convert the waste heat into electrical power through the use of heat exchangers and low pressure turbines. Adaptation of such new methods and equipment for power production may prove successful in the field of waste-heat recovery. The success or failure of the St. Louis project may well point the way for future developments in the field of waste heat utilization.

Every pound of refuse burned in a municipal incinerator produces from 1,500 to 3,500 Btu of heat energy, which is of obvious potential value if it can be used rather than vented to the atmosphere and wasted. There are plants in existence, such as that at Atlanta, where more than a pound of steam is produced for every pound of refuse burned. That this steam has value under the proper set of circumstances can be seen by analyzing the Atlanta plant's operating costs. The records for the year 1946, for instance, indicate that the revenue from the sale of steam amounted to 55 percent of the total cost of operation of the incinerator. Only a few installations, however, enjoy the unusually favorable circumstances surrounding the Atlanta plant.

Stockholm, Sweden, utilizes waste heat from refuse incineration to generate power and to heat water for a nearby military post. This operation has proved highly economical.

Estimates based on studies by the city of St. Louis for future incinerator installations indicate that up to 3,000 kw of electrical power can be developed from each 100-ton unit. At a value of one-half cent per kilowatt-hour, this represents $3.60 per ton of refuse burned.

Factors Governing Economy

These examples indicate that the utilization of waste heat can be a definite factor in reducing incineration costs provided that:

1. Satisfactory industrial or commercial outlets are available for the heat or power produced.

2. Heat can be utilized without jeopardizing the efficient operation of the incinerator.

3. The incinerator can be so located as to meet both the requirements for residential esthetic appeal and proximity to the power user.

4. The cost of operating and maintaining the waste-heat exchangers and power-producing equipment is not in excess of the value of the waste heat or power produced.

The capacity of the incinerator and the quantity of material handled will, to a very great extent, determine the feasibility of waste-heat utilization. Small incinerators, producing insignificant quantities of waste heat, will have little importance in any waste-heat utilization program. On the other hand, large-scale incinerators producing considerable quantities of heat should make a program of waste-heat utilization economically advantageous and might attract industries searching for inexpensive sources of heat or power. Even though the instances in which waste-heat utilization has proved successful are few, each incinerator installation should be seriously studied to weigh the possibilities in this direction.

(The information contained in this article was compiled by the authors in the preparation of Technical Bulletin No. 5, "Municipal Incineration," published by the Sanitary Engineering Research Project, University of California, 1952.)

How would you do it?

Some of the most fascinating chapters in the life and memory of an engineer are those dealing with the unusual and unexpected situations which almost got him down but from which he finally emerged the victor.—H. J. Gilkey

Illustrative of elementary mechanics is the painter working from a movable scaffolding or sling suspended from the eaves of a building, who lowered and raised himself along the face of a wall by a rope which went over a pulley hung from the eaves. Normally the free end of the rope was tied to the scaffolding, but on one occasion he secured the rope to a husky spike projecting from the building. The eaves immediately failed. The jury awarded the man no damages, having been convinced by the defense that the painter introduced an unwarranted hazard when he tied the rope to the spike instead of to a point on the scaffolding or sling. Would you have tied the rope to the spike? For solution, see page 90.

EDITOR'S NOTE.—This is the third installment of a series which started in the February 1952 issue of CIVIL ENGINEERING. In the April issue an article "The Unexpected in Engineering—The Bugs" explains the project and enlarges upon the central theme that problems of the past created the practice of the present—that "The engineering of today rests upon a coral reef, sturdy remnants of yesterday's bugs." The process is a continuing one; there will always be today's and tomorrow's bugs to add zest and gray hairs to the practice of a profession that in its very nature must cantilever from a credited past to an untried future. "Long live bugs" is an ever present challenge to the virility and ingenuity of the engineer. If you have a good bug, why not share it?—HJG

ENGINEERS' NOTEBOOK

Uniformly loaded beams designed by chart

WILLIAM H. CONNOLLY, Research Associate, Department of Building and Engineering Construction, MIT, Cambridge, Mass.

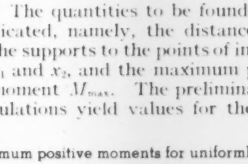
A new method for finding points of inflection and maximum positive moments in beams is provided by the chart here presented (Fig. 1). This method applies to the general case of a uniformly loaded beam having known values of restraining or support moments. It involves a minimum of calculation and does not require the use of construction lines.

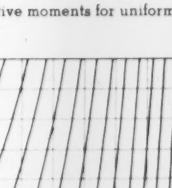
The first step is to make two preliminary calculations: (1) for the larger support moment as a proportion of WL, and (2) for the difference in the support moments as a proportion of WL, where W represents the total load on the member, and L the span length. With this information, the points of inflection can be found. They lie along those parabolic curves (on the chart, Fig. 1) which are equal in value to the larger support moment as a proportion of WL, and they are located by those intercepts on the curves which have ordinates equal to the difference in the support moments as a proportion of WL. The position of these intercepts with respect to the sides of the chart determine the distances from the supports to the points of inflection.

The maximum positive moment is found by locating that intercept on the "zero shear" line which has an ordinate equal to the difference in the support moments as a proportion of WL. The value of the parabolic curve passing through this point, multiplied by WL, gives a moment quantity from which the larger support moment is subtracted to yield the maximum positive moment. The location of the maximum positive moment, if desired, is determined by the abscissa of the intercept found above.

Example of Method

As a numerical example in the use of the chart, consider the uniformly loaded member diagrammed below.





The quantities to be found are indicated, namely, the distances from the supports to the points of inflection x_1 and x_2, and the maximum positive moment M_{max}. The preliminary calculations yield values for the larger support moment as a proportion of WL, and for the difference in the support moments as a proportion of WL, as follows:

Preliminary calculations:

$$(1)\quad \frac{M_1}{WL} = \frac{82.8}{753} = 0.11$$

$$(2)\quad \frac{M_1 - M_2}{WL} = \frac{82.8 - 42.9}{753} = 0.053$$

To find the points of inflection, locate on the parabolic curves of value 0.11 those intercepts which have ordinates of magnitude 0.053. (See points A and B, Fig. 1.) It will be noted that these intercepts are at distances of 0.260 from the right and 0.153 from the left sides of the chart. These quantities when multiplied by L give values of 5.79 ft and 3.40 ft, which are the distances from the points of inflection to the right and left supports respectively. See Steps 1 and 2 below.

Solution:

$$(1)\quad x_1 = 0.260 \times 22.25 = 5.79 \text{ ft}$$

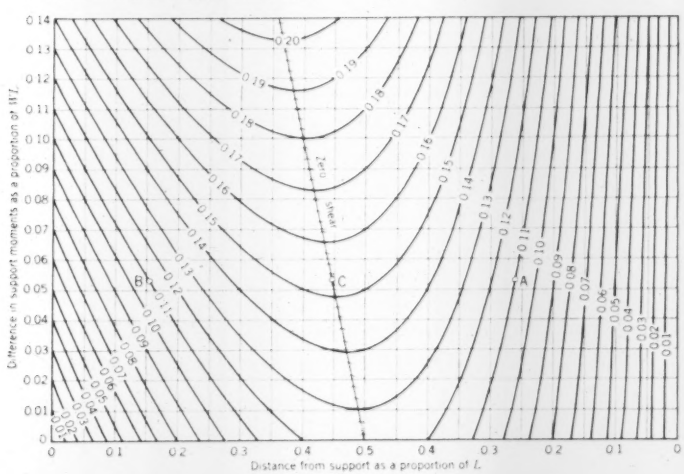
$$(2)\quad x_2 = 0.153 \times 22.25 = 3.40 \text{ ft}$$

$$(3)\quad M_{max} = 0.153\,WL - M_1 = 115.2 - 82.8 = 32.4 \text{ kip-ft}$$

To find the maximum positive moment, locate on the "zero shear" line that intercept which has an ordinate of magnitude 0.053. (See point C, Fig. 1.) The value of the parabolic curve passing through this point is 0.153. This value multiplied by WL gives a moment quantity of 115.2 kip-ft, from which the larger support moment is subtracted to yield the maximum positive moment of 32.4 kip-ft. See Step 3 above.

It should be kept in mind that the right-hand side of the chart corresponds to that support at which the larger restraining moment exists.

Fig. 1. Chart gives points of inflection and maximum positive moments for uniformly loaded beams having known support moments.



Also, in certain cases the support moments may be large enough to produce compression in the bottom fibers across the entire span. The chart will then show the points of inflection to be non-existent and the moment calculations will give the minimum negative moment. Finally, although the chart may be used if either or both restraining moments are zero, it is not applicable if they produce tension in the bottom fibers at the support.

LESTER J. GITTER, A.M. ASCE

Designer, Gibbs & Hill, Inc.

New York, N.Y.

Reinforced concrete beam formulas extended to steel-column-base design

Reinforced concrete beam formulas can be used to design anchor bolts and concrete piers supporting columns carrying relatively high moments induced by wind or other eccentric loads. The design procedure was developed by Wendt in the *Engineering Record*, Oct. 17, 1914, p. 441, and is illustrated by C. R. Young, M. ASCE, in his book, *Structural Problems* (2nd edition, 1935, John Wiley and Sons), p. 305.

The use of this method is indicated in an excellent article by A. A. Brown, "Stresses in Bolts and Piers for Wind Loads on Columns," (*Engineering News-Record*, July 7, 1949, p. 64). The procedure is shown graphically in Fig. 1.

$$C = \tfrac{1}{2} f_c kbd = A_s f_s + N \qquad (1)$$

Taking moments about A_s,

$$Ne - \tfrac{1}{2} f_c kbd^2 + \tfrac{1}{6} f_c kbd^2 = 0 \qquad (2)$$

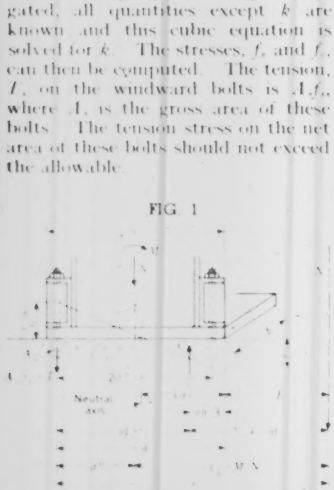
$$p = \frac{A_s}{bd} = \frac{f_c}{f_s} \frac{n(1-k)}{k} \qquad j = 1 - \frac{k}{3}.$$

Using these relationships, k can now be found from the equation,

$$dk^3 + 3(e - d)k^2 + 6np(e - d)k = 6np(e - d) \qquad (3)$$

When a design is being investigated, all quantities except k are known and this cubic equation is solved for k. The stresses, f_s and f_c, can then be computed. The tension, T, on the windward bolts is $A_s f_s$, where A_s is the gross area of these bolts. The tension stress on the net area of these bolts should not exceed the allowable.

FIG. 1



The following simplification in design method is suggested. For design, the allowable stresses are known, and it is possible to compute directly the unknown quantities, A_s, b, d, and kd, without having to solve a cubic equation.

Consider, for example, a column in which N = 24,000 lb; wind moment, M = 720,000 in.-lb, anchored with two bolts on each side; n = 12; allowable f_s on the net area of the anchor bolts = 26,667 psi; and the allowable f_c = 1,200 psi.

Since the depth of the column is known, the distance, $2d''$, between the anchor bolts can be set. Let this distance be 19 in. The tension in the anchor bolts may be estimated by dividing the moment by the estimated length of plate, a.

$$a = 19 \text{ in.} + 2(2.5 \text{ in.}) = 24 \text{ in.}$$

$$\text{Approx } A_s f_s = T = \frac{720{,}000 \text{ in.-lb}}{24 \text{ in.}} = 30{,}000 \text{ lb}$$

$$\text{Net area required} = \frac{30{,}000 \text{ lb}}{26{,}667 \text{ psi}} = 1.12 \text{ sq in. (for two bolts)}$$

Use two 1-in.-dia bolts (net area 1.102 sq in., gross area 1.570 sq in.).

Since f_s on the net area of the bolts is 26,667 psi, f_s on the gross area of the bolts (embedded in the concrete) is

$$26{,}667 \text{ psi} \times \frac{A_{net}}{A_{gross}} = 26{,}667 \text{ psi} \times \frac{1.102}{1.570} = 18{,}750 \text{ psi}$$

$$A_s f_s = T = 18{,}750 \times 1.570 = 29{,}400 \text{ lb}$$

Then k may be found from the relationship,

$$k = \frac{n}{n + (f_s/f_c)} = \frac{12}{12 + \frac{18{,}750}{1{,}200}} = 0.434$$

$$j = 1 - k/3 = 1 - 0.145 = 0.855$$

$$e_1 = \frac{M}{N} = \frac{720{,}000 \text{ in.-lb}}{24{,}000 \text{ lb}} = 30 \text{ in.}$$

$$e = e_1 + d'' = 30 \text{ in.} + \frac{19 \text{ in.}}{2} = 39.5 \text{ in.}$$

Taking moments about a point $kd/3$ from the compression edge of the plate,

$$Ne - jd) = A_s f_s jd$$

$$24{,}000(39.5 - jd) = 29{,}400\, jd$$

$$jd = 17.8 \text{ in.}$$

$$d = \frac{17.8 \text{ in.}}{j} = \frac{17.8 \text{ in.}}{0.855} = 20.8 \text{ in.}$$

From a summation of the vertical forces,

$$\tfrac{1}{2} f_c kbd = A_s f_s + N$$

$$\tfrac{1}{2} f_c kbd = 29{,}400 \text{ lb} + 24{,}000 \text{ lb} = 53{,}400 \text{ lb}$$

$$b = \frac{53{,}400}{\frac{1}{2} \times 1{,}200 \times 0.434 \times 20.8} = 9.87 \text{ in.}$$

Use a plate 24 in. × 10 in.

Suppose an existing design is being investigated. The plate dimensions and anchor bolt area and location are given. The stresses, f_s and f_c, are required.

Given: N = 24,000 lb; e = 39.5 in.; d = 21.5 in.; b = 10 in.; two 1-in.-dia bolts (net area 1.102 sq in., gross area 1.570 sq in.); n = 12.

Assume j = 0.875; then k = 0.375; jd = 18.8 in.; kd = 8.06 in.

$$Ne - jd) = A_s f_s jd$$

$$24{,}000(39.5 - 18.8) = (1.570) f_s (18.8)$$

$$f_s = 16{,}850 \text{ psi}$$

$$A_s f_s = 26{,}400 \text{ lb}$$

$$\tfrac{1}{2} f_c kbd = A_s f_s + N$$

$$\tfrac{1}{2} f_c (10)(8.06) = 26{,}400 + 24{,}000$$

$$f_c = 1{,}250 \text{ psi}$$

The value of k is correct when

$$k = \frac{n}{n + (f_s/f_c)} = \frac{12}{12 + \frac{16{,}850}{1{,}250}} = 0.470$$

$$j = 1 - k/3 = 0.843$$

(Continued on page 54)

4 major reasons why Permutit is

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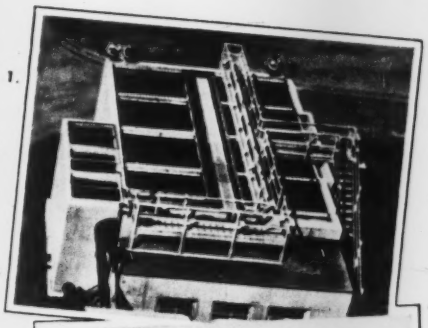

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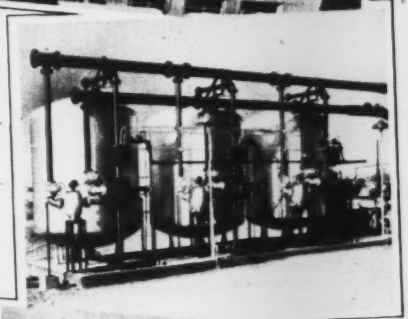

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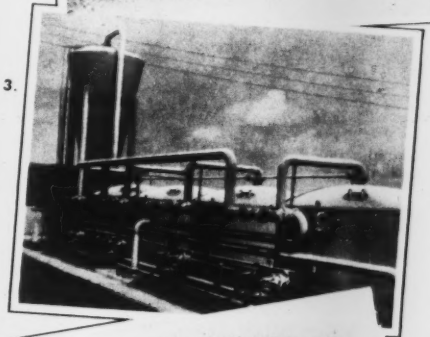

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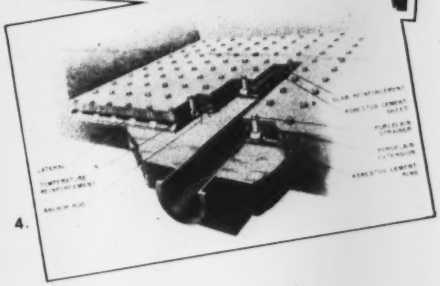

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Taking the average of the two j values

$j = \frac{1}{2}(0.875 + 0.841) = 0.858$, $k = 0.422$, $f_s = 17{,}500$ psi, A_s $f_s = 27{,}200$ lb, $f_c = 1{,}130$ psi

$$k = \frac{n'}{n' + (f_s/f_c)} = \frac{12}{12 + \frac{17{,}500}{1{,}130}} = 0.440$$

$$j = 1 - k/3 = 0.853$$

Repeating this step, the correct final values are

$k = 0.432$, $j = 0.856$, $kd = 18.4$ in., $kd = 7.90$ in., $f_s = 17{,}500$ psi, $A_s = 27{,}000$ lb, $f_c = 1{,}110$ psi, f_c on net area of bolts = 25,000 psi.

A rapid method of investigation is given in the *Reinforced Concrete Design Handbook* of the American Concrete Institute, p. 21, Example 11. The quantities, m, q, and k, are found from Table 11, and j may be found from Table 10.

$$m = \frac{30.5}{21.5} = 1.84$$, $j = 0.86$ (estimated), $n = 12$, $pn = 0.0875$,

$$r = \frac{1}{1 - (jd - c)} = 1.88$$

$$rpn = m = q = \frac{n A_s}{bd} = 0.0875 \times 1.88 = 0.165$$

$$k = \sqrt{m^2 + 2q} - m = 0.432,$$

$$j = 1 - k/3 = 0.856,$$

$$r = \frac{1}{1 - (jd - c)} = 1.87$$

$$f_c = \frac{N}{jA_s} \times \frac{c}{d} = \frac{24{,}000}{0.856 \times 1.570} \times 1.87 = 17{,}550 \text{ psi}$$

$$f_s = \frac{f_c}{n} \times \frac{k}{1 - k} = \frac{17{,}550}{12} \times \frac{0.432}{0.568} = 1{,}110 \text{ psi}$$

Another method of investigation, which requires no charts or tables, is given in the Portland Cement Association's booklet, *Analysis of Small Reinforced Concrete Buildings for Earthquake Forces* (1946), p. 17. kd is estimated. The transformed area, $bkd + nA_s$, or A, is found. The statical moment, Q, and the moment of inertia, I, are found about the compression edge of the plate.

$$Q = b\,\tfrac{1}{2}(kd)^2 + nA_s d \qquad (4)$$

$$I = b\,\tfrac{1}{3}(kd)^3 + nA_s d^2 \qquad (5)$$

Compute $E = \frac{\text{Moment}}{N} - \frac{a}{2}$ (See Fig. 1.)

If kd has been correctly chosen, it should satisfy the equation,

$$kd = \frac{I + (EQ)}{Q + (EA)} \qquad (6)$$

In case of discrepancy, use the new value of kd and recalculate A, Q, and I by correcting the concrete terms. Based on these new values, calculate a new value of kd. Using the final value of kd, compute the stresses by the following formulas:

$$f_c = \frac{NE + Q}{I - Q^2} \qquad (7)$$

$$f_s = nf_c\left(\frac{d - kd}{kd}\right) \qquad (8)$$

As a check,

$$kd = \frac{f_c\, d}{f_c + nf_s} \qquad (9)$$

THE READERS WRITE

Splitter Walls in Canal Transitions Built as Result of Model Study

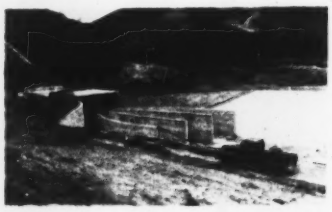
To the Editor: Readers interested in hydraulic model studies will recall the description of studies made for the transition sections on the Santa Cecilia Canal, part of the Paraiba Pirai Diversion Project in Brazil, described by Emmett M. Laursen, A. M. ASCE, in the January 1951 issue, pp. 44-47. These model studies showed the necessity of splitter or training walls at two hydraulic transitions which will eventually carry a flow of 5,630 cfs from high velocity flows in restricted sections to low velocity flows in shallow, unlined open canal sections. At transition No. 1, the rectangular discharge portal of Santa Cecilia tunnel widens out and the bottom rises to meet a shallow earth canal with sides sloping about 1 on 2; and No. 3, an expansion from a narrow, deep rock cut to another section of earth canal of similar cross section. The two transitions have two functions. One is to provide an efficient hydraulic transition recovering as much as is practicable of the velocity head reduction. This is important as this water is lifted through the Santa Cecilia pump station and any head recovery reduces the pumping cost. The other function is to achieve a uniform flow to avoid erosion problems in the unlined sections of the canal.

These transition sections, as completed in reinforced concrete, are shown in the accompanying photographs. A detailed description of the Paraiba Pirai Diversion Project was given by Adolph J. Ackerman, George O. Vogan, and the writer (then Construction Manager, Hydroelectric Construction Dept. of COBAST), in two articles which appeared in the October and November 1951 issues.

Work on this project has progressed according to schedule. The first unit in each of the pumping stations was completed and tested early this year and the canal sections carried 1,900 cfs during that time. Formal inauguration of the project was on March 1st, 1952. It will be several years before the transitions are called upon to carry the design quantity of water.

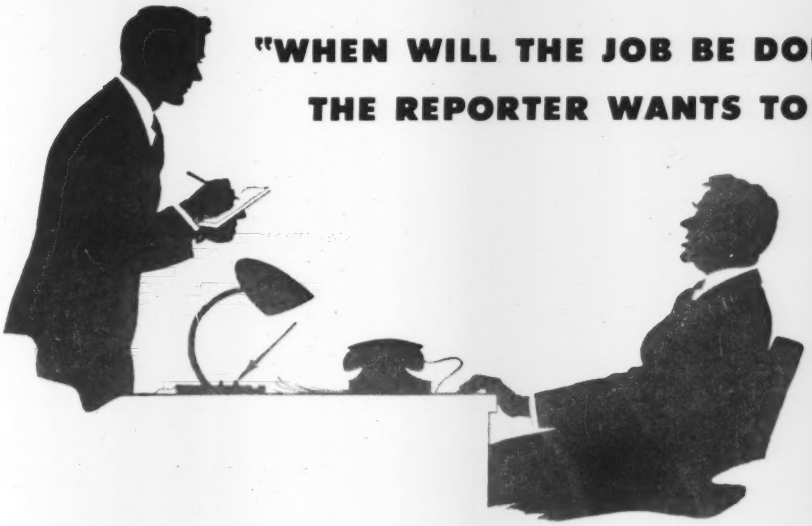
FRANKLIN T. MATTHIAS, M. ASCE
Assistant Manager, Project British Columbia Aluminum Co. of Canada, Ltd.
Vancouver, B.C., Canada

(The Readers Write is continued on page 58)



Transition sections on Santa Cecilia Canal, Brazil, were designed with splitter walls to spread flow evenly, without excessive scour. Transition No. 1, above, connects section emerging from tunnel portal with earth canal, and Transition No. 3, below, connects rock cut with another earth canal. At No. 1, foundation conditions are particularly poor, so a relatively short structure was desired. Requirements for No. 3 were still more exacting since it is located near the middle of an S-curve.

"WHEN WILL THE JOB BE DONE?" THE REPORTER WANTS TO KNOW



Q. *As chief engineer, will you tell me about the plans for the new turnpike?*

A. Well, I can say plans are up in the air.

Q. *You mean there'll be a delay?*

A. On the contrary. We're mapping the entire area from the air. We'll have complete, detailed, accurate topographic maps of a 1-mile wide route strip in a fraction of the time it would take to survey the route by rod and transit methods. Aero Service of Philadelphia is doing the job.

Q. *What about the cost?*

A. Less than half the cost of ground methods.

LOOK AT THESE FIGURES:

	Ground Method		AERO Method	
	*Cost Est.**	*Time Est.**	*Cost*	*Time*
Penna. Turnpike Extension	$415,000	2½ years	$83,000	145 days
Bear Mountain Highway Link	74,400	2 years	17,500	90 days
210,000 Acre AEC Facility	—*Not available for release*—			160 days
City Mapping, Durham, N.C.	180,000	5 years	30,000	7 mos.

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Helicoidal Staircases Have Interesting History

To the Editor: Professor Maguel's interest in prestressed concrete is well known. In his article "Revolutionary Staircase Built of Pre-Stressed Concrete" in the September 1951 issue he states that the staircase he designed is a daring structure which could not be built of the usual reinforced concrete.

Certain it is that helicoidal staircases of conventional reinforced concrete construction have been designed and built successfully. Two examples have already been furnished by other readers: that in San Jose, Calif. (November 1951 issue, p. 56) and that in London, England (February 1952 issue, p. 52). A third example deserves mention, if for no other reason than its proximity to ASCE headquarters in New York City. This staircase, in the building known as 1407 Broadway, at West 39th Street, was constructed from structural plans from the office of Severud-Elstad-Krueger, consulting engineers. It is illustrated here.

Various other examples of such "geometrical" staircases have appeared from time to time in engineering and architectural journals, all presumably of conventional reinforced concrete design and construction. Incidentally, some of the most beautiful examples of helicoidal staircases were constructed well over a century ago of wood. The interested reader may consult the *National Geographic Magazine* of February 1949, p. 204, for an exceptionally graceful "spiral" staircase built in Natchez in 1812. (See photo below.)

Apparently Professor Maguel resorted to prestressed concrete construction not necessarily because of the type of structure, but rather with a wary eye on the high torsional moments given by his calculations. But are not these moments exaggerated? If, to obtain a rough check, we should imagine his staircase extended to complete a full circle, and subjected to the same total uniform load ($12 \times 29{,}100$ lb), the torsional moment at each support would become

$$29{,}100 \times 6.4 = 186{,}000 \text{ ft lb}$$

a figure substantially below the author's 211,000 ft lb. Moreover, a still lower torsional moment should result from a careful analysis of the actual structure.

Professor Maguel observes that "no reliable formula exists for computing torsional stresses in very thin rectangular concrete sections." There does indeed appear to be a dearth of reliable data from torsional tests made on such sections in reinforced concrete, although considerable work has been done with homogeneous, isotropic materials. It is hoped that other readers will submit to CIVIL ENGINEERING pertinent data and references, if such are available.

In closing, the writer wishes to point out some drafting errors in the author's Fig. 2, in which the diagram appears to have been inadvertently reversed. The upward reaction of 37,500 ft lb per ft should be at the left, at A_1, and the tensile (hold down) reaction of 28,100 ft lb per ft at the outer edge, at B_1. Furthermore, the curved arrow representing the torsional moment reaction should be pointed in the opposite direction to that shown.

VICTOR R. BERGMAN, A.M. ASCE
New York, N.Y.

Helicoidal staircases have a long history. That of wood, at left, was designed for Auburn, ancestral home of Duncan family, built in Natchez, Miss. in 1812. Photo is reproduced by special permission from *The National Geographic Magazine* (February 1949 issue, p. 204). Staircase above, of reinforced concrete, is in New York City building at 1407 Broadway, constructed in 1950 from plans of Severud-Elstad-Krueger.

Correction to Article on Pipeline Bridge Stabilization

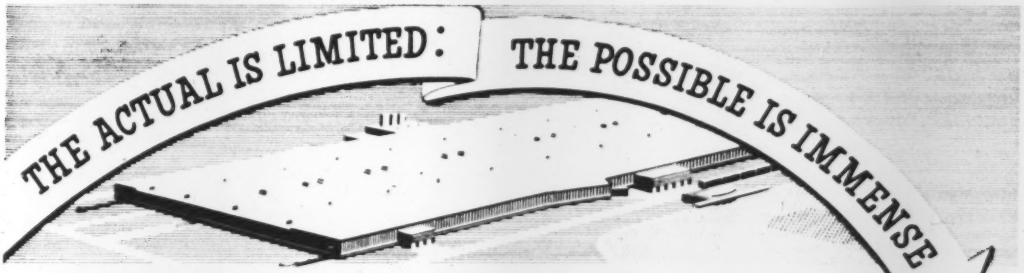
To the Editor: An error appears in my article, "Pipeline Bridge Stabilized with Diagonal Rope Stays," in the March issue, page 27. In the second paragraph of the first column, the phrase "rupture from a normal stress" should read "rupture from abnormal stress."

D. B. STEINMAN, M. ASCE
Consulting Engineer
New York, N.Y.

Mechanical Analysis of Sediments Useful

To the Editor: In his article, "'Normal' Size Distribution Found in Samples of River Bed Sand," in the February 1952 issue, p. 89, Mr. F. Blench has called attention to a very convenient method of representing mechanical analyses of sediments which the civil engineer can use advantageously. The fact that the logarithms of the particle sizes of natural sediments are frequently found to be normally distributed immediately makes available a fund of knowledge in the field of statistics which can be applied to the sediment problem.

When the graph of logarithm of grain size against percentage coarser is a straight line, we can read from the graph the geometric mean size, and the standard deviation of the logarithms of the sizes. The geometric mean size is the size reading at the intersection of the straight line and the 50 percent line. The standard deviation, which is a measure of the range in sizes, is the logarithm of the ratio of the size corresponding to 15.9 percent coarser and the geometric mean size. The ratio of these two sizes, which is called the geometric standard deviation, is



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

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WELDED DESIGN SPEEDS ERECTION...

cuts construction costs 23%

By W. A. Repp

Repp & Mundt, Inc., Contractors

Columbus, Indiana

A FASTER, simpler method for constructing buildings with welded steel has gained several important benefits for our clients. For example, on this 500-ton framework, welded design enabled three—5-man crews to set and weld all steel in only 70 days. The structural cost for fabricating and erecting came to only $150 per ton as compared to $195 for traditional methods.

After construction was under way the owner decided to add a second story because of an increase in business. To accommodate his request required only to increase the column and beam sizes for the first floor and transfer original columns and beams to the second floor. With this design neither the owner nor the contractor was penalized through increased costs or delays in construction time.

Using simple, stiff leg derricks, columns were positioned on embedded base plates. When a number of columns were erected, beams were hoisted in position and welded. Structural members, like brackets and braces, were flame cut on the job and welded as required.

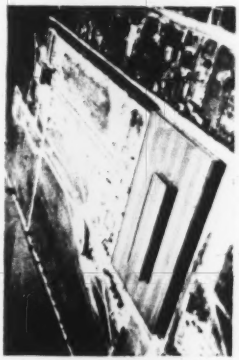

Fig. 3—120,000 Square Foot Factory Building *for The Hamilton Manufacturing Company, Columbus, Indiana. Factory will eventually enclose all the area to the boiler house.*

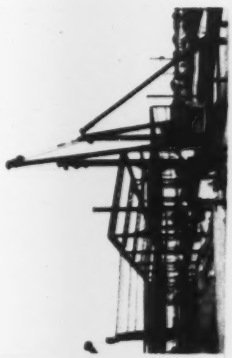

Fig. 4—Erecting Columns *using 1½ ton stiff leg derrick.*

WELDED DESIGN ALWAYS SAVES STEEL AND LOWERS COST

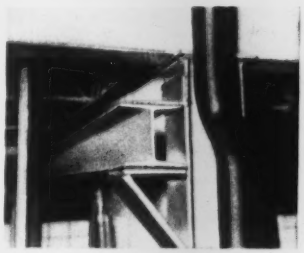

Fig. 1—Typical Beam-to-Column Connection *designed for second floor loading of 200 pounds per square foot. Columns are 8" x 8" and beams 12" x 12" H beams. Also shows bracket for crane rail.*

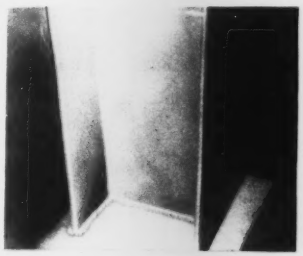

Fig. 2—Column-to-Base Detail — *Joint is welded in position after column is erected and plumbed.*

HERE'S MORE PROOF

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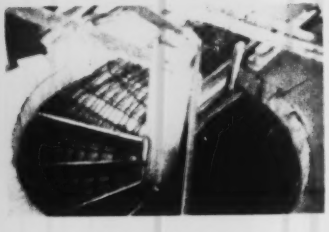
usually used to indicate the spread in sizes rather than the logarithm of the ratio $\frac{D_{84}}{D_{16}}$. *Journal of Sedimentary Petrology*, Aug. 1950, pp. 62-70) has presented a method of determining statistical parameters of sediments when the logarithms of the sizes are no longer normally distributed.

The geometric standard deviation of the sizes of the sediments whose mechanical analyses are shown in Fig. 1 is the same for all samples and has a value of approximately 1.3. This is a most interesting finding which is brought out by the use of the probability graph. It would be interesting to see if the sediments of other streams show similar relationships.

VITO A. VANONI, M. ASCE
Associate Professor of Hydraulics
California Institute of Technology
Pasadena, Calif.

Spiral Staircase of Reinforced Concrete Built in Israel

To the Editor: In connection with Prof. G. Magnel's article in the September 1951 issue, and the resulting letters to the editor on the subject of helicoidal staircases, I would like to draw attention to a helicoidal reinforced concrete staircase designed and constructed for the Sharon Hotel in Herzlia, Israel in 1948. This staircase is shown under construction in the accompanying photograph.



The total turn of the stair is 432 deg with an intermediate support at 315 deg, which was introduced to eliminate high torsional stresses. The thickness of the slab, measured normal to the surface, varied from 7 in. at the outside edge to 2 in. at the inside edge of the stair. The reinforcing consisted of fourteen 10ϕ mm and three 16ϕ mm longitudinal bars distributed evenly in the top and bottom of the slab, and 10ϕ mm stirrups placed radially at 5½ in. center to center, as measured on the exterior edge of the stair. The thickness of the slab and the amount of reinforcing were governed by the local code requirement that torsional stresses should not exceed 200 psi.

The entire hotel was designed by Z. Rechter, architect of Tel Aviv. The staircase was designed structurally by the writer.

MICHAEL BAR SHANY, A.M. ASCE
Berkeley, Calif.

Denmark Reports Spiral Staircase Three Stories High

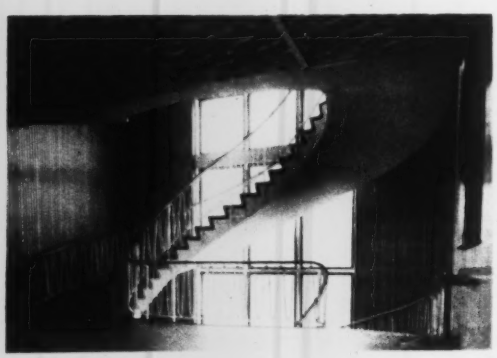
To the Editor: It might be of interest to note that a helicoidal staircase similar to those pictured in the September and November 1951 issues, was recently designed and built using conventional reinforced concrete construction.

The staircase is located in the Administration Building of the new American Tobacco Co. factory, Copenhagen, Denmark, which was designed by Hans Rahlff, architect, and Rasmussen & Schiotz, civil engineers. Rasmussen & Schiotz were also contractors for the job.

This staircase runs from basement to ground floor, from there to the first floor and thence to the second floor. It is supported and anchored only at each floor slab. The staircase slab has a thickness varying from 7½ to 10 in. measured vertically. The design loads are 130 psf for dead load and 75 psf for live load, or a total of 205 psi on horizontal projection.

The reinforcement consists of longitudinal steel bars of ½ in. diameter, placed so that they are normal to radial sections at all points. Hoop type stirrups of ¼ in. diameter, placed radially, are spaced 6 in. center to center, measured along the center line of the staircase.

NIELS ROSTOCK JENSEN
Rassmussen & Schiotz
Copenhagen, Denmark



Spiral staircase in Administration Building of new American Tobacco Co. factory in Copenhagen, Denmark, combines grace and utility. Structure, which extends from basement to second floor, is of conventional reinforced concrete design, supported and anchored only at each floor level.

Origin of Column Design Method Traced

To the Editor: The procedure for the design of eccentrically loaded steel columns described by Professors Willig and Cunningham (December 1951 issue, p. 53) certainly deserves the interesting comment it has received. It is a great time saver.

Just as a matter of interesting history I should like to call attention to the fact that a complete presentation of practically the same method was given in *Engineering News-Record* for October 21, 1926, page 662, by Prof. E. W. Rettger of Cornell University. I have been using it in class work and in design since that time.

Professor Rettger called it the "add-area method for columns with eccentric and lateral loads." He went ahead to say that it had been suggested previously in the familiar text, *Modern Framed Structures*, by Johnson, Bryan, and Turneaure. It therefore has quite a history. In developing the formula, Professor Rettger showed that its use did not at all depend on any particular type of column formula.

I have found the term $\frac{Mc}{S_{max}r^2}$ preferable to the term $\frac{MB}{S_{max}}$ but this is a question of individual preference and is of no particular moment.

D. M. MCCAIN, M. ASCE
Head, Civil Engineering Dept.
Mississippi State College
State College, Miss.

Grandpa Never Threw a Thing Away

It's only human to want to hold on to things after they've outlived their usefulness. That's why today millions of tons of worn-out and obsolete equipment and machinery are lying forgotten in the country's plants and factories and on farms.

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COSMOPOLITAN HOTEL, DENVER, COLO., JUNE 17–20, 1952

Celebrating a Century of Engineered Progress, 1852-1952

Registration

Mezzanine floor of Cosmopolitan Hotel, opens Tuesday, June 17, 8:30 a.m. each Convention day 8:30 a.m. to 5:00 p.m.

TUESDAY MORNING, JUNE 17

Student Chapter Conference

9:15 A.M. CENTURY ROOM

Student Papers
Chapter Reports

11:25 **Presidential Address to Students**
CARLTON S. PROCTOR, President, ASCE

12:15 **"Meet the Board" Luncheon**
Prize awards

1:30 **Open House at Bureau of Reclamation Laboratories**

6:30 **ASCE Stag Smoker Albany Hotel**

Throughout the days of the Denver Convention, students are cordially invited and encouraged to attend Technical Division sessions and any other Convention events.

BUREAU OF RECLAMATION SYMPOSIUM

Commemorating the Semi-Centennial Anniversary of Bureau of Reclamation

10:00 A.M. AUDITORIUM, BUILDING 56, DENVER FEDERAL CENTER

Presiding: W. E. Blomgren, President, Colorado Section, ASCE

10:00 **Welcome**
L. N. McCLELLAN, M. ASCE, Chief Engineer, Bureau of Reclamation, Denver, Colo.

10:15 **Fifty Years of Progress in Reclamation**
KENNETH MARKWELL, M. ASCE, Assistant Commissioner, Bureau of Reclamation, Washington, D.C.

11:00 **Contributions of Research to Bureau Design and Construction**
W. H. NALDER, M. ASCE, Chief Designing Engineer, Bureau of Reclamation, Denver, Colo.

11:30 **Twenty Years' Progress in Hydraulics Research**
H. M. MARTIN, M. ASCE, Head of Hydraulic Laboratory, Bureau of Reclamation, Denver, Colo.

12:20 P.M. LUNCHEON IN BUILDING 55 CAFETERIA

Introductions featuring Bureau of Reclamation officials

2:00 **Open House**
Bureau of Reclamation Engineering Center
Buildings 53 and 56, Denver Federal Center
Tour of Laboratories and exhibits

LOCAL SECTIONS' CONFERENCE

Monday, June 16
Tuesday, June 17

9:30 A.M. WESTERN ROOM, COSMOPOLITAN HOTEL

Representatives of Local Sections of ASCE in the area about the Denver Convention will convene to discuss the expanding activities of ASCE at the Local Section level.

The Conference, which is primarily for invited delegates of selected Sections, will be open to any and all who may be interested in the activities and operational details of ASCE Local Sections.

TRIP AND DINNER FOR THE LADIES

Tuesday, June 17

1:30 P.M. CENTRAL CITY

At 1:30 p.m., the ladies will leave for a visit to Central City which will include a beautiful mountain trip, a tour of this famous gold mining town, attendance at a rehearsal of the unique Central City Opera, and dinner at the historic old Teller House. The cost of this trip, including transportation and dinner, will be $5.75 per person. It is anticipated that the ladies will return from this trip at about 10:30 p.m.

MEN'S DINNER, SMOKER, SHOW

Tuesday, June 17

6:30 P.M. ALBANY HOTEL

A splendid opportunity to talk over old times and to make some new friends will be offered during a Dinner and Smoker for men only at the Albany Hotel. The program will include a buffet dinner and smoker type entertainment. Tickets for this event will be $7.50 per person. Tickets for students are available at half price.

WELCOME TO DENVER

AND

BUSINESS SESSION

Wednesday Morning, June 18

10:00 A.M. **CENTURY ROOM**

Presiding: Carlton S. Proctor, President, American Society of Civil Engineers

10:00 Welcome by Colorado Section
WALTER E. BLOMGREN, President, Colorado Section, ASCE

Welcome by the City of Denver
HON. QUIGG NEWTON, Mayor

Welcome by the State of Colorado
HON. DAN THORNTON, Governor

Response
CARLTON S. PROCTOR, President, ASCE

10:25 The Denver Convention
ALFRED J. RYAN, General Chairman

11:00 Our New Frontier
ALFRED E. PERLMAN, Executive Vice President, Denver, Rio Grande & Western Railroad

11:30 General Business Session of ASCE

12:00 Adjournment for Membership Luncheon

WEDNESDAY, JUNE 18

Division Sessions

Construction Division

2:30 P.M. **CENTURY ROOM**

Presiding: A. H. Ayers, Chairman, Executive Committee, Construction Division

2:30 **Construction of Dam No. 22, Denver Water Board**
D. D. GROSS, M. ASCE, Chief Engineer, Denver Board of Water Commissioners, Denver, Colo.

Discussion
GEORGE P. McINDOE, Assistant Project Superintendent, Macco, Puget Sound Co., Denver, Colo.

3:00 **Construction Features of Boulder-Denver Turnpike**
ROBERT D. WILSON, General Superintendent, Peter Kiewit Sons' Co., Denver, Colo.

3:30 **Construction of Hungry Horse Dam**
CLYDE H. SPENCER, Construction Engineer, Hungry Horse Project, Montana, Bureau of Reclamation

LADIES' ENTERTAINMENT

LADIES' HEADQUARTERS, BOARD ROOM, COSMOPOLITAN HOTEL

Tuesday, June 17

1:30 p.m. Tour to Central City for sightseeing and dinner

Wednesday, June 18

9:00 a.m. Coffee hour and reception in Empire Room

12:15 p.m. Membership Luncheon

6:00 p.m. Chuck Wagon Dinner

Thursday, June 19

11:30 a.m. Luncheon at Lakewood Country Club

6:30 p.m. Dinner-Dance

Friday, June 20

12:15 p.m. Family Luncheon, Silver Glade Room

AUTHORS' BREAKFASTS

8:15 A.M. **PIONEER ROOM**

Wednesday, Thursday and Friday

Briefing sessions for all speakers, discussers and program officials. Attendance by invitation. Presiding: WALTER E. BLOMGREN, Chairman of Technical Program.

MEMBERSHIP LUNCHEON

Wednesday, June 18

12:15 P.M. **SILVER GLADE**

A Membership Luncheon at 12:15 in the Silver Glade will feature the annual address of the Society President, CARLTON S. PROCTOR, who will be introduced by R. J. TIPTON. The President of the Colorado Section, WALTER BLOMGREN will preside at this luncheon. Tickets for the luncheon will be $3.00 per person.

Engineering Mechanics Division

2:30 P.M. **EMPIRE ROOM**

Fluid Dynamics Session

Presiding: John S. McNown, M. ASCE, Assoc. Prof. and Assoc. Director, Inst. of Hydr. Research, Univ. of Iowa

2:30 **Development of Turbulent Boundary Layer on Steep Slopes**
WILLIAM J. BAUER, J.M. ASCE; Research Assoc., Inst. of Hydr. Research, Univ. of Iowa, Iowa City, Iowa

3:00 **Application of Flow Analysis to Vaned Elbows**
EDWARD SILBERMAN, M. ASCE; Assoc. Prof., St. Anthony Falls Hydraulics Lab., Univ. of Minnesota, Minneapolis, Minn.

3:30 **Effect of Viscosity and Seepage on Concentration of Sediment in Suspension**
I. R. BARTON, Assoc. Prof., Civil Engineering, Univ. of Utah, Salt Lake City, Utah; ROBERT WILDE, Research Fellow, Colorado Agric. and Mech. College; and M. L. ALBERTSON, J.M. ASCE; Prof., Civil Engineering and Head, Fluid Mechanics Research, Colorado Agric. and Mech. College, Ft. Collins, Colo.

4:00 **Effectiveness of Salt Barriers in Rivers**
GARRIS H. KEULEGAN, Senior Physicist, National Hydraulic Laboratory, National Bureau of Standards, Washington, D. C.

Irrigation and Drainage Division

2:00 P.M. **CLUB ROOM**

Presiding: Harold Conkling, Chairman, Executive Committee, Irrigation and Drainage Division

2:00 **Forecasting Methods of Operation of Multiple-Purpose Projects**
LEON F. MACA, M. ASCE; Engineer, Hydrology Branch of Division of Project Planning, Bureau of Reclamation, Denver, Colo.

2:30 **Legal Aspects of Multiple-Purpose Water Projects and Trans-Basin Exportation of Water**
JEAN S. BREITENSTEIN, Attorney-at-Law, Consulting Attorney, Colorado State Water Board

3:00 **Colorado-Big Thompson Project**
HERBERT E. PRATER, M. ASCE; Regional Engineer, Region 7, Bureau of Reclamation, Denver, Colo.

3:30 **Lake Heffner Evaporation Experiments Cooperative Investigation by U. S. Geological Survey, Navy and Bureau of Reclamation**
G. EARL HARBECK, M. ASCE; Hydraulic Engineer, U. S. Geological Survey, Point Loma, Calif.

Structural Division

2:30 P.M. PADDOCK ROOM

Presiding: Stewart Mitchell, Chairman, Executive Committee, Structural Division

2:30 **A Method for Calculating Stresses in Rigid-Frame Corners**
HARVEY OLANDER, Structural Engineer, Bureau of Reclamation, Denver, Colo.

3:00 **Design of the University of Wyoming Field House**
MILO S. KETCHUM, JR., A.M.ASCE, consulting engineer, Denver, Colo.

3:30 **Timber Construction, an Expansible Industry for Emergency Needs**
M. W. JACKSON, A.M.ASCE, Univ. of Colorado.

CHUCK-WAGON DINNER AND ENTERTAINMENT

6:00 P.M., WEDNESDAY, RED ROCKS THEATER

The program for Wednesday night will consist of a Chuck Wagon Dinner and entertainment to be held at the unique open-air Red Rocks Theater located at the base of the mountain range. Dinner will be served chow line style from chuck wagons immediately adjacent to the theater site. The entertainment will feature historical Indian dances, western singing and western style square dancing. The cost of tickets for this event will be $4.00 per person. Transportation, where necessary, will be provided at a nominal cost.

THURSDAY MORNING, JUNE 19

Division Sessions

Construction-Structural Divisions (joint session)

9:00 A.M. CLUB ROOM

Presiding: Raymond Archibald, Member, Executive Committee, Construction-Structural Divisions

9:00 **Foundations and Design of Granby Pumping Plant**
WILLIAM H. WADE and WILLIAM R. TUDD, A.M.ASCE, Engineers, Bureau of Reclamation, Denver, Colo.

9:30 **Construction of Granby Pumping Plant**
R. J. WILLSON, Engineer, Bureau of Reclamation, Denver, Colo.

10:00 **Construction of Granby Dam**
ED. H. HONNEN, Project Manager, Granby Constructors, Denver, Colo.

10:30 **Discussions**

Engineering Mechanics Div.

9:00 A.M. COLORADO ROOM

Presiding: Douglas McHenry, Member, Executive Committee, Engineering Mechanics Division

9:00 **Calculation of Stresses and Deflections in Transversely Loaded Plates Under Boundary Conditions of Elastic Support**
S. J. FUCHS, M.ASCE, Development Engineer, Multum Design Company, Brooklyn, New York.

9:30 **Stiffness Charts for Gussetted Members Under Axial Load**
J. E. GOLDBERG, M.ASCE, Prof., Civil Engineering, Purdue Univ., West Lafayette, Ind.

10:00 **Numerical Analysis of Continuous Frames in Space**
JAMES P. MICHALOS, M.ASCE, Assoc. Prof., Civil Engineering, Iowa State College, Ames, Iowa.

10:30 **Analysis of Strain Measurements in Dams by Use of Punched Card Machines**
J. M. RAPHAEL, M.ASCE, and J. R. BRUGGEMAN, Bureau of Reclamation, Denver, Colo.

Hydraulics Division

9:00 A.M. EMPIRE ROOM—SHIRLEY-SAVOY HOTEL

Presiding: Morrough P. O'Brien, Chairman, Executive Committee, Hydraulics Division

9:00 **Prototype Behavior of Morning-Glory Spillways**
L. N. BRADLEY, A.M.ASCE, Head, Structure Section, Hydraulic Laboratory, Bureau of Reclamation, Denver, Colo.

9:30 **Determination of Pressure Controlled Profiles for Morning-Glory Spillways**
W. E. WAGNER, Hydraulic Engineer, Bureau of Reclamation, Denver, Colo.

10:00 **Performance Tests on the Prototype and Model of the Hearte Butte Morning-Glory Spillway**
A. J. PETERKA, A.M.ASCE, Asst. Head, Structures Section, Hydraulic Laboratory, Bureau of Reclamation, Denver, Colo.

10:30 **Discussion by**
GEORGE E. BARNES, M.ASCE, Head, Dept. of Civil Engineering Mechanics, Case Institute of Technology, Cleveland, Ohio.

11:00 **Hydraulics of Closed-Conduit Spillways**
FRED W. BLAISDELL, A.M.ASCE, Project Supervisor, Soil Conservation Service, St. Anthony Falls, Hydraulic Lab., Minneapolis, Minn.

11:30 **General discussion**

Soil Mechanics and Foundations Division

9:00 A.M. PADDOCK ROOM

Presiding: Robert F. Blanks, Chairman, Executive Committee, Soil Mechanics & Foundations Division

SYMPOSIUM: Soil Problems in Great Plains States

9:00 **Silt Injection for Stabilization of Loess Soils**
GEORGE E. JOHNSON, M.ASCE, Chief Engineer and General Manager, Central Nebraska Power and Irrigation District.

9:45 **Denver Stockyards Stadium**
DR. RALPH B. PECK, M.ASCE.

10:30 **Foundation Problems Trenton Dam, Frenchman-Cambridge Project, Nebraska**
ELLIS ARMSTRONG, Construction Engineer, M.ASCE.

THURSDAY AFTERNOON, JUNE 19

Division Sessions

Hydraulics Division

2:00 P.M. EMPIRE ROOM, SHIRLEY-SAVOY HOTEL

Presiding: Morrough P. O'Brien, Chairman, Executive Committee, Hydraulics Division

2:00 **Studies of the Use of Pervious Fence for Stream Bank Revetment**
JOHN T. O'BRIEN, A.M.ASCE, Director, Waterfront Structures Div., U. S. Naval Civil Engineering Research and Evaluation Lab., Port Hueneme, Calif.

Discussion
CHARLES W. THOMAS, A.M.ASCE, Flood Control Engineer, Soil Conservation Service, San Francisco, Calif.

2:40 **Factors Influencing Rate of Sediment Movement in High Plains of Northeastern Wyoming**
H. V. PETERSON, A.M.ASCE, Staff Geologist, Geological Survey, Salt Lake City, Utah.
RICHARD F. HADLEY, Geologist, Geological Survey, Salt Lake City, Utah.

3:15 **Total Sediment Load Measured by Turbulence Flume**
PAUL C. BENEDICT, M.ASCE, Regional Engineer, Geological Survey, Lincoln, Nebr.
MAURICE L. ALBERTSON, J.M. and ASCE, Prof., Civil Engineering, and Head, Fluid Mechanics Research, Colorado A&M College, Ft. Collins, Colo.

STUDENT CHAPTER FACULTY ADVISERS' CONFERENCE

Thursday, June 19

9:30 A.M. WESTERN ROOM

Faculty Advisers from ASCE Student Chapters in the Rocky Mountain area will convene for a one-day discussion of Student Chapter problems.

This conference, which is primarily for invited advisers, will be open to all Contact and Junior Contact Members of Chapters and others interested in the activities and operational details of ASCE Student Chapters.

MEMBERSHIP LUNCHEON

Thursday, June 19

12:15 P.M. LINCOLN ROOM, SHIRLEY-SAVOY HOTEL

There will be a men's luncheon at 12:15 in the Lincoln Room at the Shirley Savoy Hotel. It is believed that the one speech contemplated will keep those who attend laughing through the afternoon Technical Sessions.

DINNER AND DANCE

Thursday, June 19

CENTURY AND SILVER GLADE ROOMS

6:00 Cocktails

7:30 Dinner

9:00 Dancing and Entertainment

This affair will be a highlight of the Convention. All Members and their guests are cordially invited to attend.

Dress will be informal.

Tickets covering all activities of the evening are $6.50 per person.

DONALD Q. MATEJKA, J. M. ASCE, Hydraulic Engineer, Geological Survey, Lincoln, Nebr.

Discussion

WHITNEY M. BORLAND, A. M. ASCE, Head, Sedimentation Section, Bureau of Reclamation, Denver, Colo.

4:00 **Suspended Sediment in Relation to Shape of Alluvial Channels**

THOMAS MADDOCK, JR., Chief, Irrigation Operations Branch, Bureau of Reclamation, Washington, D. C.

LUNA B. LEOPOLD, A.M. ASCE, Hydraulic Engineer, Water Resources Division, Geological Survey, Washington, D.C.

4:30 General discussion

Irrigation and Drainage Division

2:00 P.M. COLORADO ROOM, SHIRLEY-SAVOY HOTEL

Presiding: George S. Knapp, Member, Executive Committee, Irrigation and Drainage Division

2:00 SYMPOSIUM on Canals—15-minute papers

1. Seepage Losses in Earth Canals

DALE M. LANCASTER, A.M. ASCE, Hydraulic Engineer, Bur. of Reclamation, Denver, Colo.

2. Results of Studies on Design of Stable Channels

EMORY W. LANE, M. ASCE; Consulting Hydraulic Engineer, Bureau of Reclamation, Denver, Colo.

3. Lining Program for Irrigation Canals

I. B. HOSIG, M. ASCE, Engineer, Canals Branch, Bureau of Reclamation, Denver, Colo.

Discussion

H. S. MEISSNER, M. ASCE, Research Engineer, Bureau of Reclamation, Denver, Colo.

4. Design Problems in Pipe Distribution Systems

HOWARD G. CURTIS, M. ASCE, Engineer, Canals Branch, Bureau of Reclamation, Denver, Colo.

5. Metering Gates for Pipe Distribution Systems

JOSEPH B. SUMMERS, J.M. ASCE; Hydraulic Engineer, Bureau of Reclamation, Denver, Colo.

3:30 Discussion

Soil Mechanics and Foundations Division

2:00 P.M. PADDOCK ROOM

Presiding: Robert F. Blanks, Chairman, Executive Committee, Soil Mechanics and Foundations Division

2:00 Current Events in Soil Mechanics and Foundation Engineering (10-minute presentations)

1. A Discussion of the Load-Bearing Test, Its Use and Applicability

A. E. CUMMINGS, M. ASCE; Research Engineer, Raymond Concrete Pile Co., New York, N.Y.

2. Possibilities of Radioactive Isotopes as a Tool in the Field of Soil Mechanics

D. J. BELCHER, M. ASCE; Cornell University.

3. Electrical Stabilization of Soils

E. F. PREECE, M. ASCE; Corps of Engineers, Washington, D.C.

4. Control of Expansive Clay Soils in Building Foundations

S. J. BUCHANAN, M. ASCE; Prof., A. & M. College of Texas.

5. Use of Various Types of Soils and Methods of Construction for Lining Canals

V. S. MEISSNER, M. ASCE; Bureau of Reclamation, Denver, Colo.

6. Soil Conditions in the Denver Area

W. R. JUDD, A. M. ASCE; Bureau of Reclamation, Denver, Colo.

7. A Discussion of a Large Number of Old Earth Dams in the Eleven Western States

JAMES L. SHERARD, M. ASCE; Bureau of Reclamation, Denver, Colo.

8. Soil Mechanics and Foundation Engineering Practices in Bureau of Public Roads

WILLIAM L. EAGER, M. ASCE; Division Materials Engineer, Bureau of Public Roads, Denver, Colo.

Waterways Division

2:00 P.M. CLUB ROOM

Presiding: Wendell E. Johnson, M. ASCE, Chief Engineering Division, Missouri River Division, Corps of Engineers, U. S. Army

2:00 **The Fort Randall Dam and Reservoir Project**

HENRY J. HOEPFER, District Engineer, Omaha District, Corps of Engineers.

2:45 **Kansas River on the Loose**

L. J. LINCOLN, M. ASCE; District Engineer, Kansas City District, Corps of Engineers.

3:30 **Channel Stabilization of the Missouri River**

RAYMOND L. HUBER, M. ASCE; Engineer, Omaha District, Corps of Engineers.

FRIDAY MORNING, JUNE 20

Division Sessions

Air Transport Division

9:00 A.M. EMPIRE ROOM

Presiding: Terry J. Owens, Member, Executive Committee, Air Transport Division

9:00 Correlation of Runway Design Procedure

ROBERT J. HOOVER, JR., A.M. ASCE

Discussion by members of Committee on Correlation of Runway Design Procedures

10:00 Revenue Bond Financing for Airport Improvements

JAMES C. BUCKLEY

General discussion

Highway Division

9:00 A.M. PADDOCK ROOM

Presiding: Ben H. Petty, Chairman, Executive Committee, Highway Division

9:00 The Development of an Interstate Route with Its Urban Connections

DAN W. ORMSBEE, M. ASCE; Colorado State Highway Dept.

9:45 Colorado's Long-Range Highway Plan

ROBERT E. LIVINGSTON, Colorado State Highway Dept.

10:15 Denver-Boulder Turnpike

RODERICK L. DOWNING, M. ASCE; Member of State Highway Commission; Prof., Civil Engineering, Univ. of Colorado.

Power Division

9:00 A.M. CENTURY ROOM

Presiding: Byron O. McCoy, Chairman, Executive Committee, Power Division

9:00 Colorado-Big Thompson Project Power Development

S. M. DENTON, M. I.E.E., and H. L. NEVE, M. ASCE, Engineers in the Design Division of Chief Engineer's Office, Bureau of Reclamation, Denver, Colo.

10:00 Novel Features of Diversion and Outlet Works, Boysen Dam and Power Plant, Wyoming

RICHARD WHINNERAH, A.M. ASCE; Design Engineer of the Dams Branch, Bureau of Reclamation, Denver, Colo.

11:00 Vibration in Hydroelectric Power Plants

SAMUEL TUDOR, M. ASCE; Head of Structural Design Branch, Bureau of Reclamation, Denver, Colo.

Waterways Division

9:00 A.M. CLUB ROOM

Presiding: Wendell E. Johnson, M. ASCE, Corps of Engineers, U.S. Army

9:00 The Canal and Locks near St. Louis, Mo., By-Passing the Chain of Rocks Reach, Mississippi River

A. F. GRIFFIN, M. ASCE; Upper Mississippi Valley Division, Corps of Engineers.

9:45 The Upper Minneapolis Harbor Development, St. Anthony Falls Project, Mississippi River at Minneapolis, Minn.

L. G. YODER, District Engineer, St. Paul District, Corps of Engineers.

10:30 Obsolescence in Navigation Locks and Dams

RALPH BLOOR, M. ASCE; Engineer, Office, Chief of Engineers, U.S. Army.

MEMBERSHIP LUNCHEON

Friday, June 20

12:15 P.M. SILVER GLADE ROOM

A farewell luncheon for men, women and—especially the younger folks, will be held in the Silver Glade Room at 12:15. The entertainment at this luncheon will be something that the entire family will enjoy. Tickets will be $2.25 per person.

FRIDAY AFTERNOON, JUNE 20

Division Sessions

Surveying and Mapping Division

2:00 P.M. PADDOCK ROOM

Presiding: William H. Rayner, Chairman, Executive Committee, Surveying & Mapping Division

2:00 Surveying Operations for Locating Radio Relay Stations

L. M. SCHINDEL, Outside Plant Design Engineer, American Telephone & Telegraph Co.

3:30 Public Land Lines in the West

W. R. BANDY, M. ASCE; Regional Chief of Engineering, Bureau of Land Management, Billings, Mont.

Sanitary Engineering Division

2:00 P.M. EMPIRE ROOM

Presiding: Frank Woodbury Jones, Chairman, Executive Committee, Sanitary Engineering Division

2:00 Stream Pollution

WILLIAM N. GAHR, A.M. ASCE; Division of Sanitation, Colorado State Board of Health.

2:30 Algae Responsible for Taste and Odor in Domestic Water Supplies

GEORGE J. TURRE, Sanitary Engineer, Denver, Board of Water Commissioners.

3:00 Putting a Sewage Treatment Plant into Operation

BENJAMIN BENAS, M. ASCE; Senior Civil Engineer in Charge, Sewer and Waste Treatment Division, Department of Public Works, San Francisco, Calif.

City Planning Division

2:00 P.M. CLUB ROOM

Presiding: Harry W. Alexander, Chairman, Executive Committee, City Planning Division

2:00 Water for Greater Denver

EARL L. MOSLEY, M. ASCE; Manager, Denver Water Board, Denver, Colo.

2:45 Denver's Master Street Plan

JOHN S. MARSHALL, M. ASCE; Design Engineer, City of Denver.

3:15 Traffic Engineering and Mass Transporation

HENRY A. BARNES, Traffic Engineer, City of Denver; Member, Institute of Traffic Engineers.

PLANNED TOURS

Trip No. 1. Denver Sightseeing by Bus

FRIDAY, JUNE 20, 1:30 P.M.

Hotel to Colorado's Capitol and Denver Civic Center; West Sixth Avenue Freeway to Denver Federal Center; Alameda Avenue to Denver's Red Rocks Theater; Mt. Vernon Canyon Road to Denver's Mountain Park and Buffalo Bill's Grave at top of Lookout Mountain, Golden to Inspiration Point; Berkeley Park and Lake; West 38th Avenue to Denver's new reinforced concrete Coliseum (9,000 seats); City Park and back to hotel. 65 miles, 4 hours. Cost $2.50 per person.

Trip No. 2. Post Convention Excursion to Colorado-Big Thompson Project

SATURDAY AND SUNDAY, JUNE 21 AND 22, BY PRIVATE CARS

An opportunity to enjoy the rugged beauty of the Rocky Mountains is being offered engineers and their families during the Convention in Denver. This trip provides for an inspection of the many features of the Bureau of Reclamation's mammoth Colorado-Big Thompson trans-

mountain diversion project. Located in the northeastern part of the state, parts of the project are practically within the boundaries of the Rocky Mountain National Park. A two-day tour is planned for all who care to make the trip: engineers, their ladies and their families.

Leaving Denver at 9:00 a.m. by private automobile, the cavalcade will travel over the new Boulder Turnpike to Boulder, Colo., through the campus of the University of Colorado. Proceeding thence along the foothills of the Rocky Mountains, the group will see the Carter Lake Reservoir, Flatiron Afterbay Dam, Power Plant and Pumping Plant. A box lunch will be served at this point. The party will then proceed to the Horsetooth Reservoir and next drive up colorful Big Thompson Canyon to the Olympus Dam and Estes Power Plant. In this vicinity are also the St. Mary's Power Plant and the east portal of the 13-mile-long Alva Adams Tunnel under the Continental Divide.

Lodging will be had at the picturesque mountain resort village of Estes Park in Rocky Mountain National Park. Accommodations can be secured at the famous Stanley Hotel (of Stanley Steamer fame) to suit the visitor's purse, from $9.00 to $21.00 per person, including dinner and breakfast.

The following morning, the motorcade will pass through the Rocky Mountain National Park over famed Trail Ridge Road constructed in part well above timber line, and reaching a maximum elevation of 12,216 ft above sea level. On arrival at Grand Lake, the western gateway to the park, inspection of the features of the project on the western slope will be resumed. Lunch will be had at the tourist village of Grand Lake.

After lunch, the west portal of the Alva Adams Tunnel, Shadow Mountain Dam, Granby Dam, and Granby Pumping Plant will be seen. The return route to Denver will take the party over U.S. Highway No. 40, past the west portal of the Moffat Tunnel, and over Berthoud Pass (El. 11,314). If desired, at this point an aerial trip over the double-chair ski lift may be taken to an altitude of 12,500 ft. Descent from Berthoud Pass takes the group through Colorado's old gold-mining district over the new Clear Creek Canyon Highway with its many tunnels and past the Colorado School of Mines campus at Golden. Approximate time of return to Denver will be 6:00 p.m. Reservations for this trip should be made early at the Registration Desk.

Trip No. 3. Colorado-Big Thompson Project

SATURDAY, JUNE 21, BY BUS

This trip will leave Denver at 8:30 a.m., Saturday, June 21, with all in attendance traveling by bus. It is essentially the same as the first day of the two-day excursion described under Trip No. 2. The use of buses instead of private cars will allow a considerable saving in time and a more comprehensive inspection of those parts of the Colorado Big Thompson Project lying on the east side of the Continental Divide. All the facilities in the Estes Park area will be included in this inspection tour. The cost of the tour, including transportation and a box lunch, will be $4.00.

Trip No. 4. Central City

SATURDAY, JUNE 21, BY BUS

Denver Valley Highway, Denver-Boulder Turnpike, University of Colorado Campus, Flagstaff Mountain, Beautiful Boulder Canyon, Peak-to-Peak Highway to Historic Central City. Gregory Gulch Lode, first gold vein discovered in Colorado, in 1859. Lunch at the Teller House, and two hours at this scenic, one-time capital of Colorado. The Face on the Barroom Floor. New Clear Creek Canyon Highway through three highway tunnels to Golden, the home of Colorado School of Mines. West Sixth Avenue Freeway, past Denver Federal Center to Denver. Distance, 115 miles. Time, 7½ hours. Cost, $5.00 per person.

Accommodations for the Younger Generation

To encourage the combining of Convention attendance with family vacations, special attention has been devoted to the younger generation. They will thoroughly enjoy the Chuck-Wagon Dinner and the Friday Luncheon. A trip to the Denver Mint and to the Museum of Natural History will be of particular interest to children.

A special committee has arranged for reliable, young companions who will be fun-finders for older children. Carefully selected baby sitters can be made available at any time. Both the companions and the baby sitters will charge only the standard rate. The committee would appreciate knowing your needs in advance. Send letters to 1340 Glenarm Place, Denver, Colo.

Guest Cards at Clubs

Guest cards for the Denver Country Club, the Lakewood Country Club, The Denver Club, the University Club and the Denver Athletic Club will be made available to interested members on request.

Information Regarding Service Clubs

Rotary Club

CARLTON S. PROCTOR will address the Rotary Club at its June 19 meeting in the Silver Glade at the Cosmopolitan Hotel. Time, 12:10 p.m. All Rotarians are invited.

Lions Club

Albany Hotel, 12:10 p.m., Tuesday, June 17. Society speaker.

Kiwanis Club

Albany Hotel, 12:10 p.m., Wednesday, June 18.

Hotel Accommodations

Headquarters for the Denver Convention will be the Cosmopolitan Hotel, located in the central business district of Denver. Anticipating an attendance greater than can be accommodated in this one hotel, facilities have been reserved in other first-class hotels. Arrangements have been made to accommodate visitors at the headquarters hotel up to the limit of capacity, in the order of request.

Send your reservation request early to assure space at the headquarters hotel. For your convenience, a special request form is provided in the advertising section of this issue (p. 97). Late requests will be assigned to other nearby hotels.

Information and Registration

Information and registration facilities will be maintained on the Convention floor of the Cosmopolitan Hotel, throughout the days of the Convention. Mail and messages will be held for Members at the Information Desk.

DENVER CONVENTION COMMITTEES

Alfred J. Ryan, *General Chairman*
Robert F. Blanks, *Vice-Chairman*
K. R. White, *Secretary*

R. N. Tracy, *Chairman, Arrangements*
E. S. Ellett, *Chairman, Entertainment*
A. W. Simonds, *Chairman, Exhibits*
R. L. Downing, *Chairman, Field Trips*
W. B. Freeman, *Chairman, Finance*
R. W. James, *Chairman, Programs*
J. S. Marshall, *Chairman, Publicity*
F. W. Thorson, *Chairman, Reception*
F. M. Bell, *Chairman, Registration*
L. C. Novak, *Chairman, Student Activities*
I. S. Rasmussen, *Chairman, Transportation*
W. E. Blomgren, *Chairman, Technical Sessions*
Mrs. F. M. Bell, *Chairman, Ladies' Committee*
Mrs. R. N. Tracy, *Vice Chairman, Ladies' Committee*
Mrs. W. H. Price, *Vice Chairman, Ladies' Committee*
Mrs. W. E. Blomgren, *ex officio*
Mrs. A. J. Ryan, *ex officio*
W. H. Thoman, Chairman, *Local Sections' Cooperation*

SOCIETY NEWS

Walter L. Huber Is Nominated for 1953 President of ASCE

Walter L. Huber, consulting engineer of San Francisco, was nominated for 1953 President of the Society by the ASCE Board of Direction at its New Orleans Convention. His election will be confirmed by letter ballot of the membership later. A full member of the Society since 1917, Mr. Huber has served it with distinction in several important posts. He was Director for District 13 from 1922 to 1924, and Vice President for Zone IV in 1926 and 1927. During his tenure of office he served on the Committees on Public Relations, Registration of Engineers, Honorary Memberships and Professional Conduct. Later he served on the Committee on Fees. In 1936 he was president of the San Francisco Section and later a member of the local legislative committee, appearing many times before committees of the state legislature on matters affecting engineers.

Following his graduation from the University of California, Mr. Huber was associated with the late John D. Galloway, Hon. M. ASCE, on the design of important hydraulic and structural projects including many assignments in connection with the rebuilding of San Francisco after the earthquake and fire of 1906. This experience kindled an intense interest in earthquake resistant design which he has followed through the subsequent years.

Mr. Huber served as district engineer of the U. S. Forest Service for a three year period, during which he directed all the engineering work of the Service in the national forests of California and Nevada. This work included reviewing and reporting on all hydroelectric projects for which federal permits were required.

In 1933 Mr. Huber established his own consulting office in San Francisco, which he has maintained without interruption since that time. Since 1941 his practice has been conducted in partnership with Edward M. Knapik, M. ASCE, a long time associate. His practice has included hydraulic and structural work over a wide area for both private interests and public agencies. He has been responsible for the structural design of many of the important structures on the several campuses of the University of California, including two 15 story units of the Medical School in San Francisco. He has also designed the structural features of numerous commercial buildings, including the foundations of the 26 story headquarters for the Pacific Telephone and Telegraph Company. One of his more unusual structures was the four story underground garage at Union Square, San Francisco.

WALTER L. HUBER
Nominee for President of the Society

Mr. Huber has also been extensively employed by financial institutions to investigate and report the structural adequacy of buildings in the seismic area of the entire Pacific Coast. Following his early training in the field of water development, he has continued to serve as a consultant for private companies, public districts and governmental agencies on various types of hydraulic projects. For many years he was consulting engineer for the California Bond Certification Commission on irrigation projects. He has also been an engineering adviser for many irrigation districts in the planning and revision of their systems and has rendered similar service on hydroelectric projects. He has been a consultant on the planning and construction of many of the West's largest dams and served on the planning stage of the Central Valley Project which included early plans for Kennett (Shasta) Dam. For the U. S. Corps of Engineers, he has been a consultant on flood control structures in Los Angeles, San Bernardino, Orange, Kern and Fresno counties, California, the work including Sepulveda, Prado, Brea, Fullerton, Santa Fe, Isabella and Pine Flat dams. In 1929 he was active during the initiating and drafting of the California State Dam Control Act, which has since been the basis for regulating all dam design and construction in the state.

During World War II and since Mr. Huber has directed the design, under architect engineer contracts with the Corps of Engineers, of several base hospitals, water supply systems, and other projects, costing some $75,000,000. Recently he was appointed to a consulting board to assist the City of San Francisco in the development of its Cherry Valley Project, a unit of its Hetch Hetchy Water Supply System. He is a member of the President's Engineering Advisory Council of the University of California.

A true Westerner, with roots in California dating back to the gold rush of 1849, Mr. Huber has been active in outdoor recreation, with particular interest in mountain areas. For 33 years he served as a director of the Sierra Club (president 1925-1926) and is credited with being the person most responsible for the creation of the Devil's Post Pile National Monument.

Information on the Centennial program may be obtained from the Centennial of Engineering, 1952, Inc., Museum of Science and Industry, Chicago, Ill.

Highway Division Appoints Local Section Contacts

To promote cooperation with the many state highway departments throughout the country, the ASCE Highway Division has appointed contact men in each Local Section located near the headquarters of a state highway department. These men will help the Division Executive Committee in the selection of committee personnel, suggest worthwhile subjects for Division technical programs, route questionnaires prepared by Division committees to proper highway department persons, and in other ways assist the Division in carrying out its functions.

A list of more than thirty members who have generously accepted the responsibility of acting as liaison men for the Highway Division follows:

Alabama—A. Reese Harvey, Jr., principal engineer, State-Wide Highway Planning Survey, Alabama State Highway Department, Montgomery, Ala.

Arizona—Ralph Hoffman, state bridge engineer, Arizona State Highway Department, Phoenix, Ariz.

Arkansas—A. E. Johnson, chief engineer, Arkansas State Highway Commission, Little Rock, Ark.

California—John C. Obermuller, assistant construction engineer, California Department of Public Works, Division of Highways, Sacramento, Calif.

Colorado—Dan W. Ormsbee, 1125 South York Street, Denver 10, Colo.

Connecticut—M. Alfred Kachrle, assistant director, Bureau of Traffic Planning Design, Connecticut State Highway Department, Hartford, Conn.

Georgia—W. F. Abercrombie, engineer of materials and tests, Georgia State Highway Department, Atlanta, Ga.

Idaho—E. V. Miller, state highway engineer, Idaho Department of Highways, Boise, Idaho.

Illinois—George L. Jackson, engineer of expressways, State Highway District No. 10, 160 N. LaSalle Street, Chicago 1, Ill.

Indiana—James T. Hallett, engineer of roads, State Highway Commission of Indiana, Indianapolis 9, Ind.

Iowa—Professor Robley Winfrey, Department of Civil Engineering, Iowa State College, Ames, Iowa.

Kansas—Paul G. Martin, engineer of highway planning, State Highway Commission of Kansas, Topeka, Kans.

Kentucky—W. O. Snyder, executive secretary, Kentucky Association of Highway Contractors, New Capitol Hotel, Frankfort, Ky.

Louisiana—N. E. Lant, chief engineer, Louisiana Department of Highways, Baton Rouge 4, La.

Maine—Vaughan M. Daggett, assistant chief engineer, Maine State Highway Commission, 79 Sewall Street, Augusta, Me.

Maryland—Allan Lee, engineer of road design, Maryland State Roads Commission, 108 East Lexington Street, Baltimore 2, Md.

Massachusetts—Edward Keane, Fay, Spofford and Thorndike, 294 Washington Street, Boston, Mass.

Michigan—E. A. Finney, director, Research Laboratory, Michigan State Highway Department, 935 Sunset Lane, East Lansing, Mich.

Minnesota—H. S. Loeffler, assistant chief engineer, Great Northern Railway Co., St. Paul 1, Minn.

Mississippi—R. A. Harris, chief engineer, Mississippi State Highway Department, Jackson, Miss.

Montana—Henry C. Helland, control engineer, Montana State Highway Commission, Helena, Mont.

Nebraska—Henry G. Schlitt, bridge engineer, Nebraska Department of Roads and Irrigation, Lincoln, Nebr.

New Mexico—George J. Johnston, 1715 Sigma Chi Road, Albuquerque, N. Mex.

New York—Conrad Lang, deputy commissioner, New York State Thruway Commission, Albany, N.Y.

North Carolina—Berrien W. Davis, state maintenance engineer, North Carolina State Highway and Public Works Commission, Raleigh, N.C.

Oklahoma—Union B. Robertson, district bridge engineer, Oklahoma State Highway Department, Oklahoma City, Okla.

Oregon—Albert G. Skelton, division engineer, Oregon State Highway Commission, Portland 2, Oreg.

Pennsylvania—Charles N. Buckius, assistant chief engineer, Pennsylvania Department of Highways, Harrisburg, Pa.

Rhode Island—George H. Henderson, principal highway engineer, Department of Public Works, Providence 2, R.I.

South Carolina—W. K. Beckham, maintenance engineer, South Carolina State Highway Department, Columbia 1, S.C.

Utah—H. S. Carter, Civil Engineering Dept., University of Utah, Salt Lake City.

Virginia—William R. Glidden, bridge engineer, Virginia Department of Highways, Richmond 19, Va.

Washington—John L. Stackhouse, Washington Department of Highways, Transportation Building, Olympia, Wash.

West Virginia—J. C. Cobb, district engineer, West Virginia State Road Commission, 1340 Wilson Street, Charleston 5, W. Va.

Wyoming—H. O. Titus, Wyoming Highway Department, Cheyenne, Wyo.

Inter-American Convention Slated for November

As part of the ASCE Centennial celebration this year, the Puerto Rico Section is sponsoring in San Juan, November 13-15, a meeting to be known as the Inter-American Convention. In tribute to ASCE, representatives of the other engineering societies on the island are cooperating with the Puerto Rico Section in the undertaking.

The name Inter-American Convention has been chosen to emphasize the fact that the objective of the gathering, in addition to celebrating the centennial year, is to foster friendly relations with our colleagues in Central and South America. Special invitations are being sent to the engineering societies in those countries to have delegates present at the convention.

An excellent program of technical papers is promised for those who attend, with considerable emphasis on problems arising in connection with engineering operations in the tropics. Inspection trips and excursions in the neighborhood of San Juan are being arranged, as well as an island-wide tour, on which much beautiful scenery as well as points of engineering interest will be seen. On this tour the visitors will have dinner on the campus of the University of Puerto Rico as guests of the School of Engineering.

A detailed program of the papers and excursions will appear in a forthcoming issue of CIVIL ENGINEERING. Etienne Totti, consulting engineer of San Juan, is the general chairman of the Convention.

New four-lane concrete highway links Rio Piedras with mid-island town of Caguas. This 13-mile highway, to be finished within year, is part of $30,000,000 highway program.

U.S. Corps of Engineers Changes Negotiated-Contract Procedures

Objections to procedures being followed by some of the engineer branches of the military services relating to so-called Architect-Engineer contracts were vigorously voiced last year by representatives of the design professions. CIVIL ENGINEERING carried a full account of these objections and of a hearing on July 16, 1951 held by the military to hear the views of the design professions, in an article entitled, "Engineers and Architects Join in Recommending Improved Procedures for Award of A-E Contracts" (August 1951 issue, page 59).

The essence of the objection registered by the civilian engineers and architects was that the procedures adopted departed from long-established custom as to the manner of negotiating fees for engineers and architects on defense projects. Instead of basing the fee on a percentage of the estimated cost of a project, this new military ruling required that the fee be based upon a detailed estimate of the cost to the engineer or architect for furnishing the professional services required. The regulation stated that these estimated direct costs should be developed by individual analysis of the services required by each item in the scope of the work. Some segments of the military advocated the development of a uniform procedure for use by the Department of Defense in connection with the employment of engineering or architectural organizations along the lines to which the design professions objected.

Since July 16, 1951, many informal contacts have been made by officers and members of national societies of the design professions with military and civilian members of the government. The views of the civilian members were pressed vigorously and continuously. As of April 2, 1952, President Carlton S. Proctor received a letter dated March 31 from Lt. Gen. Lewis A. Pick, M. ASCE, Chief of Engineers, which is self explanatory. General Pick's letter and President Proctor's reply of April 2 follow:

Dear Mr. Proctor:

A meeting was held on July 16, 1951, between representatives of the armed forces and representatives of the interested professional societies to discuss a proposed uniform procedure for use by the Department of Defense in the employment of architect-engineer services in connection with government contracts. The principal comments and recommendations which were submitted at the meeting were forwarded, through customary channels, to the Department of Defense.

I am pleased to advise the interested societies that although final action has not been taken in the matter by the Department of Defense, Department of Army action permits me to approve the use of a method of curves in determining fixed lump-sum fees for architect-engineer contracts, instead of the present detailed analysis method. Instructions have been issued to Corps of Engineers field offices to use this method whenever it is practicable to do so.

This announcement is made because the adopted method meets the major general objection raised by the interested societies to our past procedures.

Sincerely yours,
LEWIS A. PICK
Lieutenant General
Chief of Engineers

Dear General Pick:

It is with no little pleasure that I acknowledge for ASCE the receipt of your letter of March 31, 1952, advising us of the remedial change you have made in Army procedures for negotiating fixed lump-sum fees on architect-engineer contracts.

This action on your part serves to emphasize again the firm foundation of cooperation on which civilian-military relations between the Corps of Engineers and ASCE have been based for a hundred years. From time to time in the past there have been disagreements between the two groups, but none has failed of adjustment when both groups have considered all the facts.

We have complete faith that this willingness by engineers of the military services, Army, Navy, and Air Force, to work amicably with their civilian brothers of the engineering profession will continue. Through such cooperation both ways will the public interest and the interests of the men of the design professions be best served.

Very sincerely yours,
CARLTON S. PROCTOR
President, ASCE

New ASCE Banner Signalizes Centennial

New ASCE banner, which will be taken to Chicago for ASCE Centennial Convocation, is unfurled in brief ceremonies at Engineers Club in New York. Participating are President Carlton Proctor and T. Kennard Thomson, who has been member of ASCE for 64 years.

Henry T. Heald Receives 1952 Washington Award

The 1952 Washington Award was presented to Henry T. Heald, M. ASCE, newly elected chancellor of New York University and chairman of the Centennial Convocation Committee, at a dinner sponsored by the Western Society of Civil Engineers in Chicago on April 21. President of Illinois Institute of Technology from 1940 until his induction into the presidency of New York University in January, Dr. Heald is cited "for distinguished leadership in engineering education, industrial technology, scientific research, and civic affairs."

The Washington Award is administered by the Western Society of Engineers on the recommendation of a commission representing the four Founder Societies. It was founded in 1916 by John Watson Alvord as "An honor conferred upon a brother engineer by his fellow engineers for accomplishments which preeminently promote the happiness, comfort, and well-being of humanity."

Centennial Objectives Amplified at Celebration of N. Y. Founder Societies

Objectives of the ASCE Centennial celebration were discussed and further features of the year-long Centennial program were revealed by E. L. Chandler, Assistant Secretary of ASCE and Centennial Convocation manager, at a recent Centennial celebration in New York. Speaking at a meeting of the four metropolitan groups of the Founder Societies and the American Institute of Chemical Engineers held in the Engineering Societies Building (see page 72), Mr. Chandler declared that, "The Centennial presents an opportunity for all engineers to take stock, to review the accomplishments of the past, to give consideration to present-day problems, and to undertake a charting of the future." He emphasized, "The Centennial offers a significant opportunity for bringing to the public a more complete understanding of the profession of engineering and, still more important, of emphasizing for the people of the country the basic principles that have made America great."

Asserting that we have not prospered "just as a matter of course because the country is large and its natural resources are substantial," Mr. Chandler said, "It is because of the stimulus afforded by our economic system. It is because of the opportunity for exercise of individual initiative under our competitive enterprise way of life. With or without the profession of engineering, or the many other constructive forces, I think it must be agreed by thoughtful people that the country could not have advanced so prodigiously under any other economic system known to history."

In discussing the Centennial program, Mr. Chandler said the intent is to make it "a medium for bringing the truth home to our citizens." As a part of the overall program, plans include issuance of publications to that end. These will be in addition to publication of papers presented during the Convocation. One is to be directed toward young people of school age. Another will be more appropriate for adults. If plans materialize and these books can be made available, they may well be the most effective product of the Centennial from a long range point of view. "A moving picture film and appropriate radio scripts are also in the making as other means of reaching the public."

Mr. Chandler said that the script for the dramatic stage production, to be presented daily in the 1,000-seat theater at the Museum of Science and Industry, is now just about complete. It includes portrayal of a variety of significant episodes in the history of engineering and industrial development. While the entire production will have high entertainment value, the basic objective is education of the audience. Several performances will be given each day, and it is expected that hundreds of thousands of people will view the production.

Designs are also nearing completion for a special exhibit at the Museum. This, Mr. Chandler said, "will not, in any sense, be a trade show. It is intended to portray the manner in which the discoveries of science have been applied by invention, engineering and industry to the development of products conducive to our high standard of living."

"The program may be divided into two major categories. First is the series of symposium programs, distributed throughout the Convocation period. These are being arranged by the corporation, Centennial of Engineering, 1952, Inc., and are not a responsibility of any of the participating societies, as such. The object of these symposiums is to enhance evaluation of the contributions of engineering to the advancement of civilization on a world-wide pattern—past, present and future. Each subject is to be developed with appreciation of its social and economic aspects and its dramatic appeal. There are to be twelve symposiums, and we have been able to enlist the services of an exceptionally well qualified man to serve as chairman for each of them." [The list of symposium subjects and their chairmen is given in the accompanying box.]

E. L. Chandler

"The second phase of the Convocation is a multi-faceted one. Beginning on September 3 and extending throughout the Convocation period, meetings of some 50 engineering organizations are to be held. The ASCE program includes sessions of thirteen Technical Divisions and will require all or part of eight days.

"All in all, the Convocation program will provide the opportunity of a lifetime—indeed, the opportunity of the century—for any engineer to reap the benefit of scholarly papers and discussions in his particular branch of the profession. He will be able, also, to profit from sessions devoted to other fields and techniques of engineering in which he may desire information. Any person, whether or not a member of any engineering society, or even an engineer, will be gladly welcomed to registration and attendance at the Convocation sessions."

Subjects	Chairmen
Profession and Its Societies	Harry S. Rogers, President, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
Education and Training	Andrey A. Potter, Dean of Engineering, Purdue University, Lafayette, Ind.
Food	Clarence Francis, Chairman of the Board, General Foods Corporation, N. Y.
Tools	Kenneth H. Condit, Dean, School of Engineering, Princeton University, Princeton, New Jersey
Structures and Construction	Waldo G. Bowman, Editor, *Engineering News-Record*, New York
Transportation	Charles F. Kettering, Research Consultant, General Motors Corp., Detroit, Michigan
Mineral Industries	Clyde E. Williams, Director, Battelle Memorial Institute, Columbus, Ohio
Chemical Industries	Francis J. Curtis, Vice-President, Monsanto Chemical Co., St. Louis, Mo.
Communications	W. H. Harrison, President, International Tel & Tel Co., New York
Energy	Eugene Ayres, Technical Assistant to Executive Vice-President, Gulf Research and Development Co., Pittsburgh, Pa.
Urbanization	Harland Bartholomew, President, Harland Bartholomew & Associates, St. Louis, Mo.
Health and Human Engineering	Thomas Parran, Head, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pa.

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

Legislation

Several legislative developments of considerable interest have occurred during the past month. To protect the status of engineers under the Armed Forces Reserve Act of 1951 (H.R. 5426), the Engineering Manpower Commission of Engineers Joint Council has prepared testimony for presentation to the Senate Armed Services Committee at the coming hearings.

In considering appropriations for the Bureau of Reclamation for the coming fiscal year, moves were made to reduce the maximum permissible fee for consulting engineers from $100 per day to $50 per day, also to set a limit, and in fact a very low limit, on the amount that could be expended for private consulting services. A letter was sent on behalf of ASCE to the committee voicing sentiment against these proposed limitations.

An amendment of considerable interest to engineers has been introduced in connection with the extension of the Defense Production Act of 1950 which expires June 30. Under the original act fees received for professional services are exempt from the controls provisions. There has been considerable sentiment for exempting salaries paid out of these fees to professional employees. A previous amendment to the act carried out this feeling with respect to lawyers and doctors receiving salaries which in effect were paid out of fees. A proposal is now before the Senate Committee on Banking and Currency to exempt professional engineers whose salaries are for services related to a fee received. A special EJC committee has submitted a statement to the committee favoring the inclusion of professional engineers along with the doctors and lawyers already exempted. This committee has cautioned against limiting the exemption only to licensed or registered engineers. It pointed out that very few of the engineers to whom the amendment would apply are required to be licensed or registered, as distinguished from the lawyers and doctors, all of whom must be licensed. A professional employee whose salary does not stem from a fee would not be included in the exemption.

Bills relating to various aspects of retirement income are under consideration. One (S. 2481) proposes to include self-employed attorneys in the Social Security system. A committee of EJC is considering the question of the desirability of suggesting that self-employed engineers be included too. It is also considering the means of effecting this.

A bill of a more general nature (H.R. 7426) proposes amending the Internal Revenue Code to permit the deduction from gross income of the cost of certain bonds which could be redeemed at a later date and at that time included as income. This would permit averaging a year of high income with years of low income.

A Special Subcommittee on Public Works under the chairmanship of Representative Jones of Alabama is holding hearings on National Water Policy. Engineers who are members of ASCE and of other EJC societies will testify. The administration has not yet presented a legislative proposal in the matter. It is still being reviewed in the Bureau of the Budget.

Construction Under Government Controls

During the past two months the National Production Authority has been following a very liberal policy in approving applications for new construction, especially for schools, hospitals and commercial buildings. Uncertainties in steel supply due to the strike situation, and in demand for steel resulting from flood disaster work make it likely that a less liberal policy will be followed during the next month or two. Generally speaking, after this possible temporary tightening up, worries about steel should be nearly over except for large heavy plates and wide flange beams or for large projects involving several thousand tons.

Defense Department Notes

During the first eight months of the fiscal year 1952 (July 1951 through February 1952) the Defense Department obligated a total of $24.9 billion including $1.3 billion for construction. $25.6 billion is still available for obligation including $4.4 billion for construction. It is expected that most of this will be obligated before mid 1952.

The Corps of Engineers has developed a revised system for determining fees on professional services contracts for the design of military installations. This follows long drawn-out discussion of the previous fee determining practices between the Defense Department and the engineering and architectural societies.

Administration plans to present a new reorganization plan to Congress dealing with the administration of river control work along the lines of the Hoover Commission report have been abandoned.

Federal Appointments of Interest to Engineers

Pursuant to the request of the Construction Industry Advisory Council that better coordination between the various construction claimant agencies be established, the Defense Production Administration has designated John H. Martin, lumber dealer of Modesto, Calif., as Deputy Administrator in charge of Construction and Resources Expansion.

To replace the late Dr. H. G. Bennett, who was recently killed in a plane crash in Iran, Stanley Andrews has been nominated to be director of the Point IV Program of technical cooperation with underdeveloped countries. Mr. Andrews is a former Arkansas newspaper editor and director of the Office of Foreign Agricultural Relations. His recent work has related to increasing food production in Germany and Japan.

President Truman has appointed a committee to investigate Missouri River floods. Paul J. Cannell, M. ASCE, executive director of the Missouri Valley Survey Commission, will be officer in charge in Omaha.

Miscellaneous

The Salary Stabilization Board is conducting an investigation of "job pirating" practices in the engineering field. Hiring practices will be investigated in Boston, New York, Philadelphia, Baltimore, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Dallas, Los Angeles and San Francisco. The bad practices are said to present a serious problem in certain fields, especially in the aircraft industry.

Resolutions adopted by the Board of Direction in New Orleans emphasizing that surveying and mapping activities are essential parts of engineering have been sent to the U.S. Civil Service Commission. Exclusion of these activities from Civil Service engineering registers is protested.

Washington, D.C.
April 24, 1952

ASCE MEMBERSHIP AS OF APRIL 9, 1952

Members	8,066
Associate Members	10,263
Junior Members	16,036
Affiliates	67
Honorary Members	37
Total	34,469
(April 9, 1951	32,045)

FARMS THAT "GROW" CONCRETE TO BUILD A STRONGER AMERICA

Two of the strangest farms in America "grow" concrete in northern Illinois and central Georgia. They are the Portland Cement Association experimental farms, where scientists study the effects of weathering on concrete in northern and southern climates.

"Growing" here are better pavements for defense highways, stronger runways to resist the impact of huge commercial and military planes and the terrific heat of jets, walls with greater resistance to the elements for factories, schools, hospitals, homes, hangars, warehouses, stores and public buildings.

"Plantings" made on farms, starting in 1940, consist of rows of concrete slabs, posts and boxes which simulate pavements, structural columns and walls. Specimens contain different proportions and combinations of materials used in making concrete.

Research like this is a continuing and expanding activity of the Portland Cement Association. Out of this research comes technical information on the best concrete mixtures and the best construction practices for building structures exposed to all conditions of service and weather.

Such information is made public immediately and freely through the Association's field engineering service and its educational and promotional program which is made possible by the voluntary financial support of its 68 member companies.

Thus the knowledge gained in the laboratory and in field tests can be used quickly by architects, engineers and contractors in designing and building more durable and ***lower-annual-cost*** facilities needed for our general economy and the defense program.

PORTLAND CEMENT ASSOCIATION

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A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

Centennial Construction Sessions to Be Moved

Construction Division members planning to attend the Centennial Convocation in Chicago, September 3, 4 and 5 should note that the Division headquarters will be the La Salle Hotel, and not the Congress as originally planned. The change is necessitated because Chicago has decided to begin building a new superhighway early in September through the meeting room reserved for the Division.

The La Salle Hotel has been secured for all Construction Division meetings and for the joint AGC Construction Division luncheon on September 3. In addition, 300 sleeping rooms have also been set aside at the La Salle for the September 3-5 period, and 150 of these will be available from September 2 through 13. Adequate meeting and room accommodations are not available at the Centennial headquarters hotel, the Conrad Hilton.

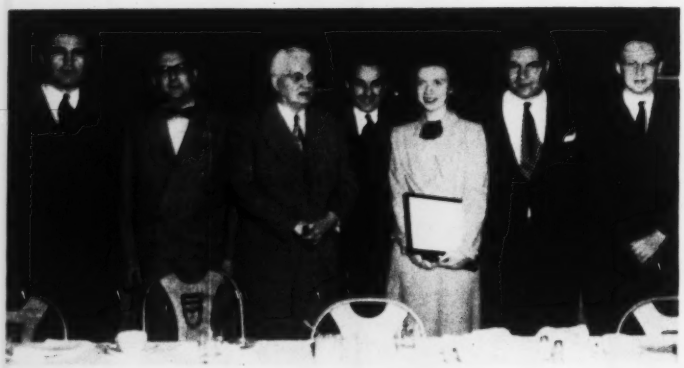
Members who plan to attend Construction Division meetings can make reservations at the La Salle Hotel, La Salle Street at Madison, Chicago, Ill. Those having reservations at the Congress may want to change them to the La Salle.

Six Construction Sessions Planned

In addition to its joint luncheon with the AGC, the Construction Division will have six Convocation sessions. These consist of a joint session with the Highway Division on Wednesday morning, September 3; a joint session with the AGC Wednesday afternoon, following the joint luncheon with the AGC; separate sessions on Thursday morning and afternoon, September 4; a joint session with the Irrigation and Drainage Division on Friday morning, September 5; and a joint session with the Structural Division on Friday afternoon. The Construction Division sessions were incorrectly listed in the item on the ASCE Technical Division sessions in the March issue.

H. P. Maxton Assembles Program

As chairman of the Construction Division's Committee on Publications and Programs, Howard P. Maxton, secretary and assistant treasurer of the Raymond Concrete Pile Co., 140 Cedar Street, New York, is assembling the Division's program.



Shown at recent highly successful joint meeting of Indiana Section and Student Chapters of Rose Polytechnic Institute, Notre Dame, and Purdue University are (left to right) Prof. B. B. Lewis, Faculty Adviser at Purdue; Prof. W. L. Shilts, head of Notre Dame School of Civil Engineering; Prof. R. B. Wiley, former ASCE Vice-President and head of Purdue Civil Engineering School; Dr. Robert F. Legget, director of building research of National Research Council of Canada and principal speaker of evening; Anna Hanson, president of Purdue Student Chapter; Prof. K. B. Woods, president of Indiana Section; and Prof. John Newlin of Rose Polytechnic Institute. Life membership awards were presented to Harry S. Marshall, of Cincinnati, and Norman H. Hill, of Indianapolis. Student Chapter awards went to Leonard D. Pyle, Rose; Carl Carlson, Notre Dame; and Edward L. White, Eugene A. Watkins, and Robert A. Rust, Purdue. In addition, Purdue faculty made special awards to Miss Hanson and Carol J. Schumaker, Section secretary.

N. Y. Founder Societies Celebrating Centennial Hear Vannevar Bush

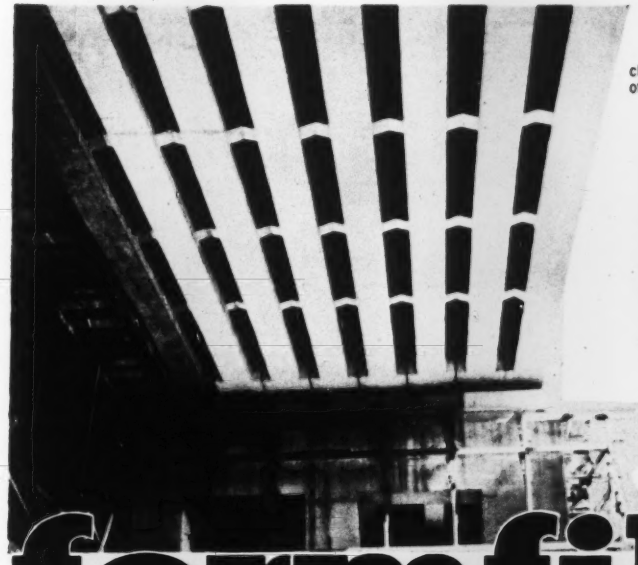
Celebrating the one hundredth anniversary of ASCE, members of the four Founder Societies and the American Institute of Chemical Engineers heard Dr. Vannevar Bush, president of the Carnegie Institution of Washington, speak. "Certainly we are in changing times," he said, "and in order to encompass them and maintain the engineering profession in its proper sphere, we need to have a profession which can itself change and which can adapt. This is the challenge before the engineering profession. There is no simple formula for meeting it."

Some 500 members of ASCE, ASME, AIEE, AIME, and AIChE were present at the jointly sponsored centennial meeting. Prior to Dr. Bush's talk, E. L. Chandler, Assistant Secretary of ASCE and manager of the Centennial Convocation, discussed plans being formulated for the Convocation in Chicago, September 3-13 (see page 69).

In speaking of the challenge to the profession, Dr. Bush declared that, "Unfortunately in our engineering education and in industry for that matter, we have often in the past lost sight of the importance of breadth and adaptability in our engineers. In attempting to become general we have often merely become superficial. We need to learn how we can develop among our young neophytes and in our profession generally those attributes which enable men to adapt themselves to change soundly, neither rushing blindly and without understanding into the novel path nor remaining in a groove which leads nowhere except into oblivion.

"Specifically, there may be a tendency to turn to the engineer only for those things that are so matured they have begun to appear in handbooks, and to turn to the applied scientist for the novel approach for the new and pioneering activity that is especially attractive from an intellectual standpoint. Much of the training of engineers leads to a compart-

(Continued on page 76)



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Heavy scratches for instance, can be quickly recoated when Formfilm is used at the job.
Formfilm is now being widely used in "tilt-up" construction.

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Coming Local Section Events

Central Illinois Meeting on June 5 to be addressed by ASCE President Carlton S. Proctor.

Central Ohio Joint dinner meeting with Student Chapter of Ohio State University, at Pomerene Hall, Ohio State University campus, May 15, 6:30 p.m.

Cleveland Dinner meeting at Tomlinson Hall, Case Institute of Technology, on May 16, at 6:30 p.m.

District of Columbia Meeting at the Cosmos Club Auditorium, May 13, at 8 p.m.

Kansas City Annual picnic honoring ASCE President Carlton S. Proctor, will be held at the J. C. Nichols Farm, May 31.

Maryland Dining meeting at the Engineers' Club, on May 14, at 6 p.m.

Metropolitan Meeting in the Engineering Societies Building, 33 West 39th St., New York, on May 21, at 8 p.m. Junior Branch will hold a dinner meeting in the Times Dining Room, New York, on May 14 at 6 p.m.

Michigan Joint dinner meeting with Student Chapter of Michigan State College, on the campus at East Lansing, Mich., on May 15.

Nebraska Meeting will be held at Lincoln, on May 21.

Pacific Northwest Conference Desert Inn, Richland, Wash., May 15-17.

Philadelphia Meeting at the Engineers' Club, on May 13, 7:30 p.m. Delaware Sub-Section meets at the University Club in Wilmington, Del., on May 20.

Sacramento Weekly luncheons every Tuesday at the Elks Temple, at 12 noon.

St. Louis Luncheon meeting at the York Hotel, St. Louis, May 26, at 12 noon.

Tennessee Valley Registration for the spring meeting will begin at 8:30 a.m. May 10, at the Oak Ridge Terrace, Oak Ridge, Tenn. The all-day program will feature a talk by Dr. D. S. Billington, director of the Solid States Institute at Oak Ridge National Laboratory.

INTER-AMERICAN CONVENTION

San Juan, Puerto Rico, November 13-15, 1952

Scheduled ASCE Conventions

DENVER CONVENTION

Cosmopolitan Hotel
Denver, Colo., June 16-20, 1952

CENTENNIAL CONVOCATION

Conrad Hilton Hotel
Chicago, Ill., September 3-13, 1952

SAN FRANCISCO CONVENTION

San Francisco, Calif., March 2-7, 1953

Ambitious plans for Denver Convention of ASCE are discussed at meeting of host (Colorado) Section by some of committeemen in charge of program. Shown here, left to right, are Alfred J. Ryan, general Convention chairman; W. E. Blomgren, president of Colorado Section and chairman of Convention Technical Program; Robert F. Blanks, Convention vice-chairman; and K. R. White, Convention secretary.

News of Local Sections Briefed

SECTION	DATE	ATTENDANCE	PROGRAM
Alaska Juneau Sub-Section	March 25	52	A. F. Ghiglione, commissioner of roads for Alaska, talked on permafrost and reviewed construction problems encountered with permanently frozen ground. Film on snow avalanche research was presented.
Buffalo	March 18	51	An illustrated talk on the Labrador Railroad was given by H. Dale Sheets, Eastern division manager, Armco Drainage & Metal Products, Inc., at a luncheon meeting.
Central Illinois	March 24	80	Life membership certificate awarded to C. M. Slavmaker at dinner meeting. Guest speaker W. L. Hindermann, district engineer, Asphalt Institute, Minneapolis, Minn., discussed the New Jersey Turnpike.
Central Ohio	March 20	24	An illustrated talk about Central America and the Carribbean islands was given by Prof. Emmett H. Karrer.
Cincinnati	March 5	83	Annual joint meeting with University of Cincinnati Student Chapter addressed by students, Irvin Harris and William Murphy. Life membership certificates presented to J. R. Biedinger, H. R. Gabriel, and N. H. Jebejian.
Cleveland	March 21	89	Dinner meeting. Dr. Jay L. Otis, director of Research and Service Center, Western Reserve University, outlined applications of psychology to problems of human relations in industry, and discussed social responsibility.
Connecticut	April 8	80	Meeting addressed by Mr. Henry W. Buck, Buck & Buck, Hartford, Conn.
Indiana	March 10	150	Guest speaker, Hal H. Hale, executive secretary, American Association of State Highway Officials, discussed the national outlook of highway construction and legislation.
Intermountain	March 10	42	Howard Williams, traffic and planning engineer, Utah State Road Commission, discussed present safety activities and operations, and E. G. Johnson, chief engineer of the State Road Commission, spoke briefly on highway financing problems.
Iowa	March 12	14	An illustrated talk on accelerated test track was given by Prof. Ladis H. Csanyi.
Kansas City and Kansas	April 8	106	Joint meeting with Kansas State College and University of Kansas Student Chapters. Dr. F. D. Farrell, president emeritus of Kansas State, presented a talk on county zoning. E. L. Chandler, Assistant Secretary of ASCE, discussed the Centennial Celebration.

The Surveyor's Notebook

Reporting on Unusual Surveying Problems and Their Solutions

Notekeeper: W. & L. E. Gurley, America's Oldest Engineering Instrument Maker

"Let's Improve Land Survey Records"

"Many current practices in land surveying are crude and outdated," says R. Getty Browning, Chief Locating Engineer, North Carolina Highway Commission. "Instrument work has become increasingly accurate through the years, but recording has not kept pace.

"Need for improvement is immediately apparent to anyone retracing a previous survey. Descriptions have often been so hastily and inefficiently written and markers so carelessly placed that it is almost impossible to follow the previous man's work.

"Here's how we can improve the quality and lasting value of our surveys:

1) Permanent monuments, referenced carefully, should always be established at the time of the survey.

2) All bearings should be referred to true North, and all measurements between monuments should be the horizontal distance.

3) Survey should be checked by latitude and departure methods and corrected to bring it within standards consistent with type of land being surveyed.

Special Gurley Transit and tripod, built in 1906 to Browning's specs, weigh about eleven pounds.

Browning has used his Gurley for land and mining surveys; finds it "most accurate" after 45 years.

4) A map should be drawn from corrected field notes and filed with county surveyor.

5) An accurate description, fully describing various corners and reference points, should accompany the map.

6) A sheet showing computations should also be filed, together with a copy of the surveyor's report—telling for whom survey was made, when it was completed, what procedure was followed.

"For some time, many engineers have proposed a geometric coordinate system for the entire nation. Before we can benefit from such a plan, we must first properly delineate the small tracts which will fit into it.

"Standardizing on such a simple, practical plan would put an end to haphazard work; eliminate confusion; protect the landowner and the community; and increase the prestige of the profession.

"This problem has bothered me since 1902, when I assisted a Maryland surveyor whose specialty was unraveling complicated surveys. Progress can be made only with surveyors and engineers using their influence to bring about a change."

We'd like to hear your reactions to Mr. Browning's ideas. And send us an unusual surveying problem or experience for this page.

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Los Angeles	April 9	135	Dr. Gilbert D. McCann, professor of electrical engineering, California Institute of Technology, gave a talk entitled "Civil Engineering Applications of the Electric Analog Computer." John C. Fiedler-john was awarded a Junior membership.
Maine	April 10	70	Annual spring conference devoted to discussion of the all-purpose development of the Kennebec River Basin. After dinner, Lawrence Pelletier, professor of government, Bowdoin College, moderated a panel discussion.
Maryland	March 12	128	Dinner meeting and cocktail hour. An illustrated talk on color photography was presented by Charles Cummins, II, and Student Chapter members discussed several topics.
Miami	March 6	31	Hon. George H. Earle, ex-Governor of Pennsylvania, gave a talk on superhighways.
Jacksonville Sub-Section	March 31		Engineering implications of the new Florida special sanitary district law were described by John W. Wakefield, sanitary engineer for the Florida State Board of Health.
Mid-South Jackson Branch	March 10	36	ASCE President Carlton S. Proctor and Mrs. Proctor were guests of honor at a dinner meeting.
Nebraska	March 14	55	Dinner meeting. H. G. Schlitt, former president of the Section and state bridge engineer for the Nebraska Department of Roads and Irrigation, addressed the group.
New Mexico	April 4	93	Spring meeting featuring an inspection trip to White Sands Proving Grounds. The dinner meeting was addressed by A. G. Clissen, consulting engineer, El Paso, Tex., who described problems peculiar to the Southwest.
Northeastern	March 24	160	Carlton S. Proctor, ASCE President, spoke on a "Century of Engineered Progress." Newly elected officers are Oscar S. Bray, president; Howard M. Turner, vice president; and Prof. Ernest L. Spencer, secretary-treasurer.
Northwestern	March 3	43	Speaker Walter V. Buck, division engineer, Bureau of Public Roads, supplemented his talk on the planning and development of the Pan American Highway with a colored film.
Providence	March 13	40	Alexander Addeo, inspector of buildings, City of Providence, discussed proposed building code at a joint meeting with the Rhode Island Society of Professional Engineers.
San Diego	March 20	45	Douglas Deaper, deputy city attorney, City of San Diego, outlined the relationship of engineers to attorneys including contracts and contractural relationships.
Tri-City	March 25	37	An illustrated talk on the Labrador Railroad was presented by Leonard L. Klein, sales engineer, Armco Drainage and Metal Products Co.
West Virginia	March 28		Spring meeting. An award as the outstanding civil engineering graduate of West Virginia University was made to Robert B. Miller. Principal speaker was Dr. F. T. Mavis, head of the civil engineering department, Carnegie Institute of Technology.

Dr. Vannevar Bush addresses joint meeting of metropolitan sections of Founder Societies in Centennial Celebration.

(Continued from page 72)

mentalization that contributes directly to this tendency." Who would think of tossing to a young electrical engineer a tough problem in the chemical engineering field? Yet this is just the sort of thing we must expect as our industrial effort becomes more ramified and as the problems we attack become more interwoven with the whole fabric of diversified science that is now being utilized unless we are willing to abdicate to the applied scientist the most congenial part of the engineer's function. I fear that only too often the young man with a scientific background is more flexible under novel circumstances than is the young engineer, and this is much to be regretted. It is to be regretted because we cannot give up the most cherished attributes of our profession—versatility and resourcefulness—without making our jobs unattractively one-sided."

As examples of the scope of science today, Dr. Bush cited the fertilization of Scottish fiords to increase fish yields; the diversion of rivers to lay down silt in swamps so that when the river is rediverted and the swamps drained, fertile land is left; development of chemical soil conditions; development of solar power for irrigation; and the further development of automatic controls.

Presentation of life membership certificates to Michigan Section members is made by Section President E. A. Finney (left) at recent Section dinner meeting. With him (left to right) are H. S. Winn, Russell Murdoch, and J. William Moffett. Similarly honored were Section members Maurice J. Quinn and Sidney D. Strong. Speakers in symposium on City-County Building under construction in Detroit included Mayor E. Cobo; Maurice Greenberg, city soils engineer; Prof. W. S. Housel, of University of Michigan, consultant on foundations of project; and Linton Hart, district manager of Raymond Concrete Pile Co.

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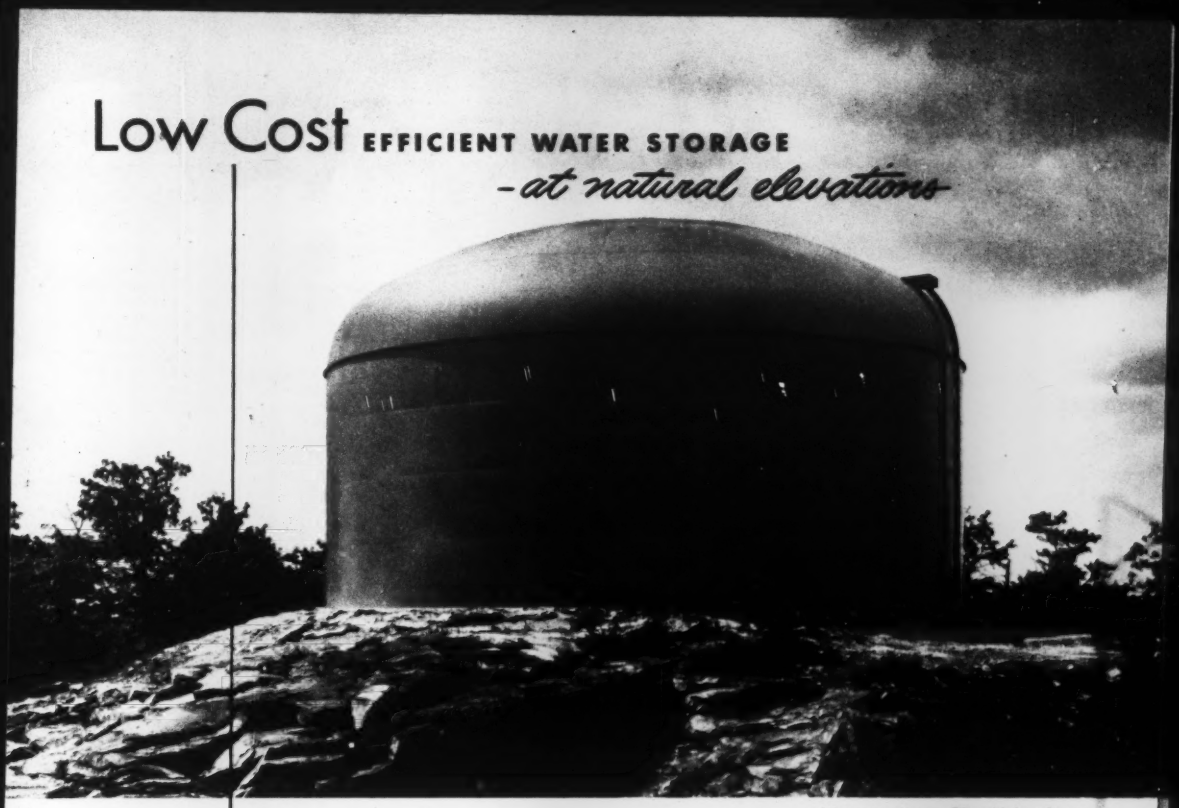
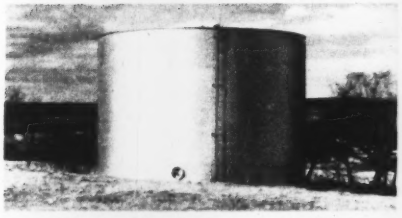
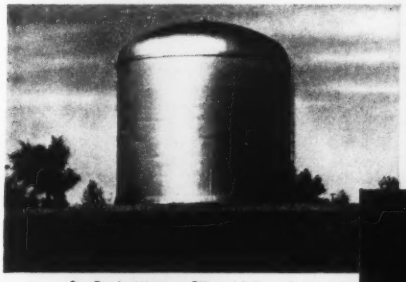


Worcester, Mass. — Ellipsoidal roof type, 1,500,000 gallons capacity.

* *Steel Reservoirs*



Liberty, N.Y. — Flat roof type, 300,000 gallons capacity.



St. Paul, Minn. — Ellipsoidal roof type, 2,000,000 gallons capacity.

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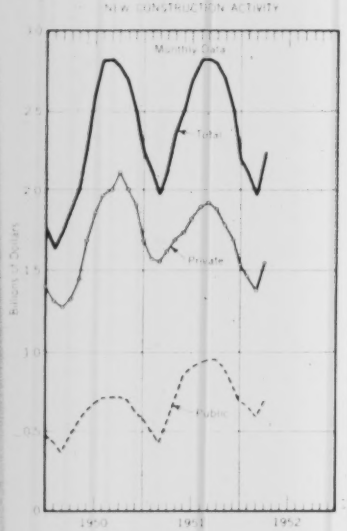
NEWS BRIEFS . . .

Record Construction Activity Reported for March

Capital outlays for new construction in March reached record levels, according to a recent joint report of the U. S. Labor Department's Bureau of Labor Statistics and the Building Materials Division of the Department of Commerce. Substantial increases in private homebuilding activity and in highway construction, in conjunction with seasonal advances in most other types of construction, brought the dollar volume of new construction for the month to about $2,225,000,000—a rise of 13 percent over February and a slight increase over the March 1951 total.



Dollar volume of new construction in March, shown in Department of Commerce curves, represents 13 percent rise over February and slight increase over March 1951 total.

The expanded construction outlays are attributed largely to increased expenditures for military and defense production facilities, which have offset declines during the past year in private residential and commercial building. Total private outlays this March were 4 percent under the March 1951 total, despite an increase of 50 percent in factory building and a slight rise in utility construction over the year. Public expenditures for the month exceeded March 1951 outlays by 18 percent.

According to the joint agencies, the upsurge in private homebuilding activity was the outstanding construction development of the month. Total expenditures for private residential building were estimated at $781,000,000—an increase of 17 percent over February and only 9 percent below the March 1951 record. Although highway construction expenditures were 55 percent greater in March than in February, they were still 23 percent below a year ago and total highway expenditures for the first quarter of the year were 20 percent under the total for the first quarter of 1951.

Total new construction outlays for the first quarter of this year were estimated at nearly $6.4 billion—about the same amount spent on new construction during the first quarter of 1951. First quarter expenditures for private residential building amounted to 16 percent less than the total for the first quarter of last year, the joint agencies note.

Treatment Standards Adopted by Ohio River Commission

Sewage treatment requirements for municipalities along the Ohio River in the 160-mile stretch between Huntington, W.Va., and Cincinnati, Ohio, were formally adopted by the Ohio River Valley Sanitation Commission at its quarterly meeting on April 2. This means that communities discharging sewage in the river from the three-state area of Ohio, West Virginia, and Kentucky are now told precisely what degree of treatment they must provide.

The new requirements call for (1) substantially complete removal of settleable solids, (2) removal of not less than 45 percent of the total suspended solids, and (3) reduction in coliform organisms not less than 90 percent reduction during the months, May through November, and not less than 80 percent during the months, December through April.

A report on river cleanup progress in the Cincinnati pool of the Ohio River, where the Commission established treatment requirements two years ago, brought out the fact that Cincinnati's Little Miami sewage disposal plant is about 40 percent complete, with start of operation in the summer of 1953 probable. Plans are also being drawn for construction of another larger plant, to be begun about 1955, that will serve the city's industrial area. On the Kentucky side of the river, Covington and 16 adjacent municipalities have formed a sanitation district to build a joint treatment works, with construction to start in June. Since enactment of a state water law five years ago, about 100 Virginia communities have built treatment works.

E. Blackburn Moore was elected chairman of the Ohio River Valley Water Commission for the coming year, and H. E. Moses, M. ASCE, vice-chairman. F. H. Waring, M. ASCE, was reelected secretary, and Robert K. Horton treasurer.

TVA Gives Contract for Shawnee Plant Facilities

The Tennessee Valley Authority has awarded contracts for construction of a dock extending 2,180 ft along the Ohio River near Paducah, Ky., and a coal unloading system to the Contracting Division of the Dravo Corporation, of Pittsburgh. Providing facilities for twelve loaded and twelve empty 195-ft coal barges, the projects will aid in fueling the $88,000,000 Shawnee Steam Plant being built by the TVA to furnish power for the Uranium-235 plant of the Atomic Energy Commission at Paducah. Construction of the harbor and unloading facilities will start in the early summer.

Philadelphia Opens New Sewage Treatment Works

Completion of Philadelphia's new $13,000,000 Northeast Sewage Treatment Works constitutes a major step in the city's long-range stream cleanup program begun in 1912. Treating all sewage entering the Delaware River above Lehigh Avenue, the plant will serve a population of 669,000 in an area having an estimated flow of 91 mgd. In addition to serving the northeastern section of the city, it will provide treatment facilities for another large area extending from the northwestern section of the city into Nicetown, Oak Lane, and much of Germantown. The new plant replaces an old Imhoff tank installation, and will utilize the original pumping station, administration building, and other facilities representing $3,500,000 in its operation.

Laboratory Established for Atomic Power Development

Recent establishment of the Walter Kidde Nuclear Laboratories, Inc., which will have the primary objective of developing commercial atomic power, is announced. The first privately financed laboratory dedicated to research in nuclear power, the organization is an associate of other Kidde enterprises. It will perform research and experimentation for other organizations interested in the design of nuclear power plants or in applications of nuclear technology to their products and processes.

The development and engineering work will be conducted at 140 Cedar Street, New York City, and laboratory research will be carried out in facilities on Long Island. Technical activities will be handled by Dr. Karl Cohen, former director of the Atomic Energy Division of the H. K. Ferguson Co., and a pioneer in the preliminary work for the Manhattan Project of the AEC.

Wolf Creek Project Starts Power Production

Production of hydroelectric power for commercial use was recently started from a fourth 45,000-kw generating unit at the Corps of Engineers' Wolf Creek flood control project in south-central Kentucky, according to an announcement from the Department of the Army. Total installed capacity at Wolf Creek Dam is now 180,000 kw. Two more units scheduled to go into production later this year will complete a projected installation of 270,000 kw. The completed Wolf Creek powerhouse will be the third largest hydroelectric plant in the East.

Brooklyn Opens Owls Head Treatment Plant

Recent opening of the new $19,000,000 Owls Head Pollution Control Plant in Brooklyn constitutes the half-way mark in New York City's $250,000,000 program for treating all its sewage in 18 modern plants by 1959. The plant is the first in the country designed for the high-rate activated-sludge process developed by the New York City Department of Public Works. In this process, the solids are digested, the resulting gas utilized, and the residue discharged at sea.

In the opening ceremonies, Mayor Vincent Impelliteri and Frederick H. Zurmuhlen, M. ASCE, Commissioner of Public Works, called attention to the fact that the new and shorter method of treatment will save the city $7,000,000 in the Owls Head Plant alone. Under the old method, Commissioner Zurmuhlen said, sewage treatment cost $20 per million gallons, whereas the new process will cut the cost to $10 per million gallons.

Treating 120 mgd of sewage from a 21-sq mile area in the Bay Ridge, Bensonhurst, Borough Park, and Flatbush sections of Brooklyn, the new plant will assure cleaner water at Coney Island, in the Narrows, and at the south shore beaches of Staten Island. Its full capacity will be 160 mgd.

Welding Saves Steel on New Rhine River Bridge

Important savings in steel are effected by use of welding in construction of new bridge across Rhine River at Cologne, Germany. This structure, which replaces bridge destroyed during war, required only 5,669 tons of steel instead of 8,500 tons used in old bridge. Despite this 30 percent saving in steel, present structure has greater capacity. Designed by Dr. Ing. F. Leonhardt, it consists of series of steel box girders, varied in depth to form shallow, parabolic curves. Spans are 404, 605, and 407 ft, cellular welded structure with D at crown L 60; and roadway is 38 ft, with two 10-ft sidewalks. Crossing is said to be longest full-web continuous-girder bridge in world. Photo courtesy of James F. Lincoln Arc Welding Foundation.

ASTM Announces Research Work on Materials

At more than 250 meetings of technical groups of the American Society for Testing Materials, held during the ASTM Committee Week in Cleveland in March, much new research work was discussed and many new specifications and test for materials and numerous revisions were completed.

As a result of action taken by Committee C-9 on Concrete and Concrete Aggregates, freezing and thawing tests for evaluating aggregates and concrete will now be recognized under ASTM designations. Three variations of this test were recommended for acceptance, consisting of rapid freezing and thawing in water, rapid freezing in air and thawing in water, and slow freezing and thawing in water or brine. A fourth method, slow freezing in air and thawing in water, is still under consideration. An additional method in the field of nondestructive testing was accepted for addition to ASTM Standard C 215, a test for fundamental transverse and torsional frequencies of concrete specimens. This method will enable Young's modulus of elasticity, the modulus of rigidity, and Poisson's ratio to be calculated on concrete prisms and cylinders. Kenneth B. Woods, M. ASCE, associate professor of highway engineering at Purdue University is chairman of Committee C-9.

Committee D-7 on Wood, which is headed by L. J. Markwardt, M. ASCE, assistant director of the U. S. Forest Products Laboratory at Madison, Wis., completed revisions in several widely used ASTM standards in the wood field. The Standard Specification for Round Timber Piles (D 25), which has stood for fifteen years without change, will have revisions, as will the standards for Testing Small Clear Specimens of Timber (D 143) and Testing Plywood, Veneer, and Wood-Base Materials (D 805). To keep abreast of industrial problems arising with the growing use of fiberboard, the committee has authorized the formation of a new subcommittee to work in the field. Wayne Lewis, A.M. ASCE, also of the U. S. Forest Products Laboratory, will be chairman of the subcommittee.

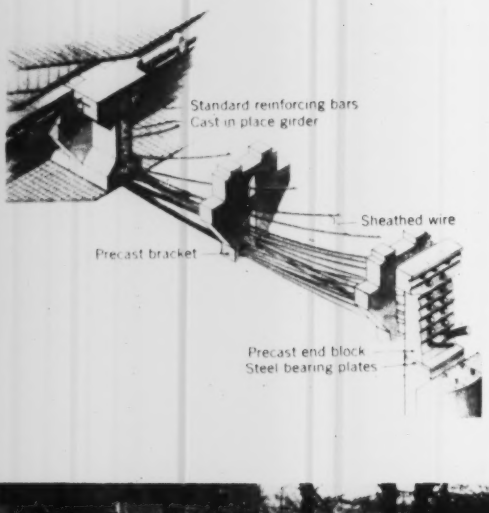
Sectional Design and Two-Stage Loading Are Applied to Cast-in-Place Prestressed Girders

Cast-in-place prestressed girders are in themselves unique in building construction in this country. When designed, as were the dining hall girders for Manhattanville College of the Sacred Heart at Harrison, N.Y., they are doubly interesting.

To insure that the top of the girder would be flush with the top of the floor slab, the slab was supported by brackets extending from the side of the girder. These brackets are precast and placed in position before forming or pouring of the girder. The girder then is not homogeneous, but rather is composed of alternate sections of girder and precast bracket over the entire length of the span, held together by the tension in the cables.

The girders are prestressed by 22 cables, each containing twelve wires. Of these, 15 cables extend through the end block, and seven emerge from the top of the girder. The pull on each cable was 26 tons. The girder was loaded in two stages, the first loading taking part of the dead load by pulling up on ten of the cables. The remaining dead load was then applied and the remaining prestress added. The ten cables originally loaded were carefully chosen so as not to unbalance the load on the end block.

The decision to use prestressed girders was made when allocations of structural steel were not available. For the span of 65 ft and a dead and live load of 222 psf, a steel girder would have had a depth of 3 ft 6 in., a reinforced concrete girder a depth of 6 ft, and the prestressed girder 4 ft. For the six girders only eight tons of steel were required, for the prestressed concrete design, whereas the reinforced concrete design would have used 40 tons, and the structural steel design 72 tons.



Precast brackets, positioned before forming or pouring of prestressed cast-in-place girders, support floor slab which will be flush with girder top (below). Section through floor and girder is shown at left. Girders are built for Manhattanville College of Sacred Heart, Harrison, N.Y. Engineers are Weiskopf & Pickworth, architects Eggers & Higgins, contractor Geo. A. Fuller Co., and contractors for prestressing Preload Company Inc.

Navy Continues Its Expansion Program

The Navy Civil Engineer Corps sharply stepped up new construction at shore establishments in 1951. It reports expenditure of more than $430,000,000 for construction of improved runways, larger hangars, test and research centers, supply and storage buildings, and related facilities. During the previous year only $67,000,000 went for such construction at shore establishments.

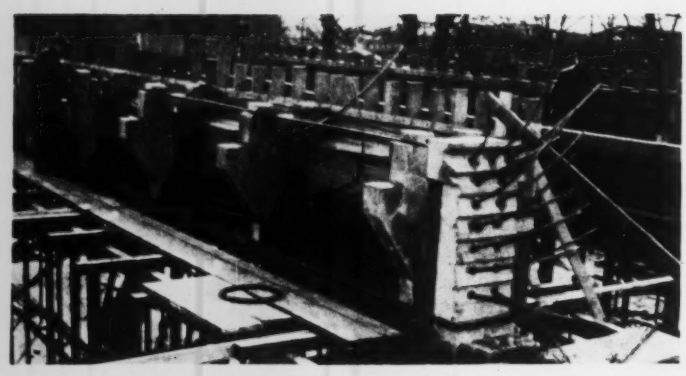
Work under way or planned for 1952 includes two additional bulk fuel storage facilities in the New England area (near Casco Bay, Me., and at the Naval Supply Depot at Newport, R.I.), totaling $4,000,000; improvements costing about $2,000,000 at the Lakehurst, N.J., Naval Air Station; construction of two warehouses and office space at the Naval Training Center, Great Lakes, Ill.; rehabilitation work on drydocks at the Philadelphia Naval Shipyard; and improvement and expansion of berthing facilities at Key West, Fla., to cost about $2,000,000. Bids for most of these projects will be advertised this spring.

The Navy also announces that it expects to have more than 11,000 of its Wherry Housing program units for Navy and civilian personnel completed by the end of 1952. Present plans call for 76 projects, with a total of 26,173 rental units. The largest single job in the entire program was started at the Marine Corps Air Station at Cherry Point, N.C., in October 1951. It calls for 1,421 units. Designs for approximately 50 projects have been completed, and bid openings for 31 projects have definitely been scheduled for the first nine months of this year.

Contract Awarded for Gavins Point Project

Progress made by the Corps of Engineers in getting the Gavins Point Project under way continues with the award by the Omaha District Office of a $3,000,560 contract to the Baldwin-Lima-Hamilton Corp., of Philadelphia, for building and installing the turbines for the powerhouse. The long-term contract, extending into March 1956, calls for three 54,000-hp turbines complete with accessories and spare parts. Before the actual work on the turbines begins, the contractor is required to build a model for testing and observation purposes.

Excavation for the powerhouse will be included in the primary earthwork contract to be let this spring. The structure, which will have an installed capacity of 100,000 kw, will be built on the Nebraska side of the river just below the dam.



Record Floods Again Strike Midwest

WRIGHT HIATT, A.M., ASCE

Lt. Col., Corps of Engineers, Office of
The Chief of Engineers, Fort Belvoir, Va.

For the second time in less than a year the Midwest was struck by disastrous floods as unusually widespread snow cover, both in depth and area, in the states of Minnesota, North Dakota, South Dakota, Montana, Wyoming, Nebraska, and Iowa, melted rapidly in the latter part of March and early April to send the Upper Mississippi, the Upper Red River of the North, and the Missouri River to the highest stages on record. Fortunately there have been no unusually heavy or warm rains to add to the floods, although it is highly probable that there will be before the upstream crests dissipate themselves in the greater valley storage downstream.

Based on predictions furnished by the U. S. Weather Bureau, the Army Engineers, along with other responsible federal agencies, took necessary steps, beginning early in March, to prepare for the potential floods. Preparations included the inspection of existing flood control works, planning of emergency flood-fighting operations, assembly of supplies, material, equipment and tools for the flood fight, and the coordination of all preparations with state and local interests.

As the warm weather continued, the number of streams above bank-full stage increased, with the result that such major tributaries as the Yellowstone, Milk, Poplar, Little Missouri, Knife, Heart, Cannonball, Grand, Moreau, Bad, White, James, Vermilion, Big and Little Sioux, and Floyd were all contributing their swollen discharges to the flooding Missouri. The flood conditions were aggravated periodically during the early stages in short reaches of both the main stem and the tributaries by the formation of ice jams. Particularly severe was the damage that resulted at Ft. Pierre, S. Dak., from the formation, at the mouth of the Bad River, of an ice jam against the larger flows in the Missouri. By the first of April, most of the ice in the Missouri was moving freely downstream from Pierre, S. Dak., and by April 4 the area of severe ice jams had moved up the river to the vicinity of Bismarck, N. Dak. By April 10, the ice problem disappeared throughout the main stem of the Missouri, as the swollen crests converged toward the cities of Bismarck, Pierre, Sioux City, Council Bluffs, and Omaha.

A few of the localities at which previous flood stage records were broken are shown in the accompanying table.

Principal existing flood control works in operation included the Fort Peck Dam, and local protection works at Glasgow, Mont., Mandan, N. Dak., Council Bluffs, Iowa, and Omaha, Nebr. Over a million acre-feet of water was stored in the Fort Peck reservoir during the critical period of the last week in March and the first week in April. The estimated effect of this storage was a reduction of 2 ft in the river stage at Omaha. The local protection projects at the previously mentioned cities held against the river's onslaught, although at Omaha and Council Bluffs a strenuous flood fight involving thousands of local citizens, National Guard, and federal troops was conducted to strengthen and reinforce existing protection.

The volume of water estimated to have passed Sioux City during the flood period (April 1 to 21) amounted to about 9,000,000 acre-ft. Had the three main-stem Missouri dams at Garrison, Fort Randall, and Oahe, now under construction, been complete and in operation during this period, they would have made available 10,500,000 acre-ft of flood-control storage to contain these flood waters. It is estimated that, without taxing the capacities of these three reservoirs in the least, and without encroaching on the storage allocated to power conservation and other purposes, the flow at Sioux City would have been held to non-damaging stages, and the flow at Omaha would have been held to 340,000 cfs as compared to the flow of nearly 400,000 cfs which actually occurred.

While the floods were rampaging through the upper and middle Missouri basin area, repairs to damaged local protection works at Kansas City, resulting from the disastrous Kansas River flood of 1951, were rapidly completed. Fortunately the Kansas River was not discharging high flows at the time the Missouri crest arrived, but even so, the Mighty Mo at Kansas City crested at several feet above flood stage, and approximately 8 ft below the maximum stage on record.

As in the flood of 1951, loss of human life was practically nil, but property damage amounted to hundreds of millions of dollars. Even so, the damages prevented by existing works amounted to more than $200,000,000.

TABLE I. SOME FLOOD RECORDS BROKEN IN 1952 FLOODS (AS OF APRIL 24)

Place	Stream	Flood Stage (1)	April '52 Crest (1)	Previous Record (1)
Missouri River Basin				
Mandan, N. Dak.	Heart R.	17	24.8	24.7 (1943)
Marmarth, N. Dak.	Little Missouri	18	23.7	21.7 (1947)
Mobridge, S. Dak.	Missouri	16	25.1	19.6 (1943)
Pierre, S. Dak.	Missouri	15	25.1	23.0 (1881)
Chamberlain, S. Dak. (2)	Missouri	18	25.6	19.5 (1943)
Sioux City, Iowa (3)	Missouri	19	24.3	22.5 (1881)
Omaha, Nebr.	Missouri	19	30.2	24.6 (1881)
Upper Mississippi Basin				
St. Paul, Minn.	Mississippi	14	22.2	19.7 (1881)
Winona, Minn.	Mississippi	13	17.9	17.4 (1951)
Hastings, Minn.	Mississippi	15	21.0	18.9 (1951)

Notes:

1. Local gage reading in feet.
2. At Chamberlain, S. Dak., on April 10, 1952, with a stage of 23.4 ft, a measurement of 412,000 cfs was made.
3. At Sioux City, Iowa, on April 14, 1952, with a stage of 24.3 ft, a measurement of 460,000 cfs was made. At Yankton, S. Dak., on April 12, 1952, with a stage of 14.7 ft, a measurement of 441,000 cfs was made.

New York Empowered to Enter Four-State Water Compact

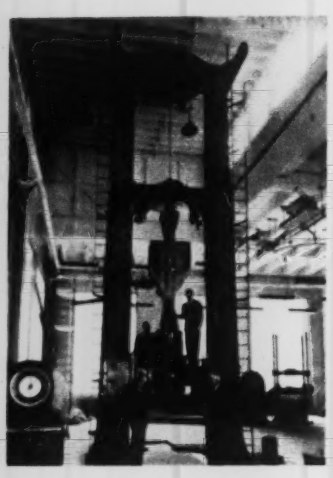
Legislation authorizing New York State to enter a compact with New Jersey, Pennsylvania, and Delaware and participate in a permanent commission to study the proposals of the Interstate Commission on the Delaware River Basin (Incodel) has been approved by Governor Thomas E. Dewey. If the new commission finds that the proposed $550,000,000 Incodel project for development and use of the water resources of the Delaware River is feasible, it is empowered to carry it out.

Governor Dewey stated that the bill "does not attempt to decide whether the future water supply of New York City should be obtained from the Delaware watershed or from other sources. That determination will depend upon comparative costs, availability and other factors." He pointed out that the bill does provide the necessary framework for joint cooperative development of the vast resources of the Delaware River Basin. "The great potentialities inherent in the project justify thorough exploration of its practicability," he concluded.

Aimed at satisfying the water requirements of New York City, the northeastern and southern areas of New Jersey, and the Philadelphia area until after the year 2000, the Incodel plan has been under study by engineers and officials for several years. Consulting engineers for the plan—the New York firm headed by Malcolm Pirnie, Past-President of ASCE, and the Philadelphia firm headed by ASCE Director Francis Friel—have recommended a two-stage development to store flood waters on the upper Delaware River and its tributaries and divert them through tunnels and conduits to the metropolitan areas of the four states.

The Incodel plan was outlined in the October 1950 issue of CIVIL ENGINEERING, page 58.

Purdue Has New Testing Machine



Dominating new Structures Laboratory at Purdue University is this new Baldwin-Tate-Emery Universal testing machine, which has capacity of 600,000 lb in tension or compression. Comparative strength of bolted and riveted joints is being determined for gusset for joint in railroad bridge structure. SR-4 resistance wire strain gages on joint and bolts will provide data on stress distribution under various loads. R. B. Wiley, M. ASCE, head of School of Civil Engineering and Engineering Mechanics, discusses test with Prof. L. T. Wyly, M. ASCE, as Kenneth Lenzen, J. M. ASCE, instructor, and Jack Carter, J.M. ASCE, assistant professor, prepare specimen for test.

Alaska Lets Airport Contract

Continuing its expansion program in Alaska, the Corps of Engineers has awarded a contract for construction of extensive outside utilities at the Elmendorf Air Force Base to joint bidders Birch & Lytle and the Green Construction Co., both of Seattle, according to an announcement from the Alaska District Engineer. The amount of the joint contract is $3,525,549.

Foundation Contract Let for Kansas Dam

Award of a contract to initiate construction of Kirwin Dam on the north fork of the Solomon River in Phillips County, Kansas, to the Cook Construction Co., of Jackson, Miss., on a low bid of $1,226,246, is announced by the Bureau of Reclamation. This initial contract covers excavation of the dam foundation.

A key structure in the program for flood control in Kansas, Kirwin Dam will be an earthfill structure, 170 ft high and 11,300 ft long, with storage space for 315,000 acre-ft of water. About two and a half years will be required for construction of the dam and reservoir.

San Diego Voters Back Second Barrel Supply

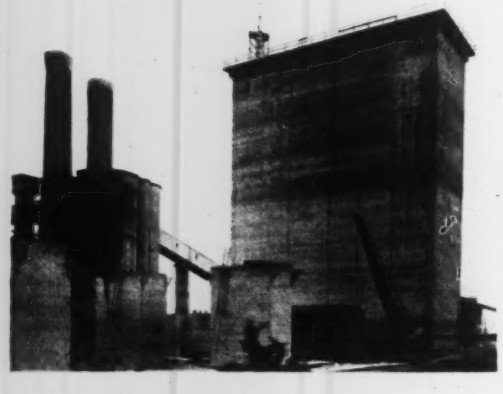
The successful outcome of four years of effort on behalf of San Diego County (California) Water Authority officials to double the city's supply of Colorado River water is reported in a recent issue of the *Colorado River Aqueduct News*. Recently residents of the area voted forty to one in favor of a second barrel to the Colorado River Aqueduct and a $6,500,000 bond issue to complete Sutherland Dam. A collateral agreement, in which the city assures the federal government priority to water from the second barrel, was also approved in the election.

According to the terms of the agreement, the U. S. Navy will build the second barrel, the County Water Authority repaying the cost of the southern portion and the District repaying the cost of the northern portion over a 40-year period. Construction of the project, which will carry Colorado River water a distance of 71 miles from the west portal of the San Jacinto tunnel into the San Vicente Reservoir near San Diego, is expected to start soon. The total estimated cost is about $18,000,000.

Granular-Steel Finish Improves Wear Resistance of Concrete

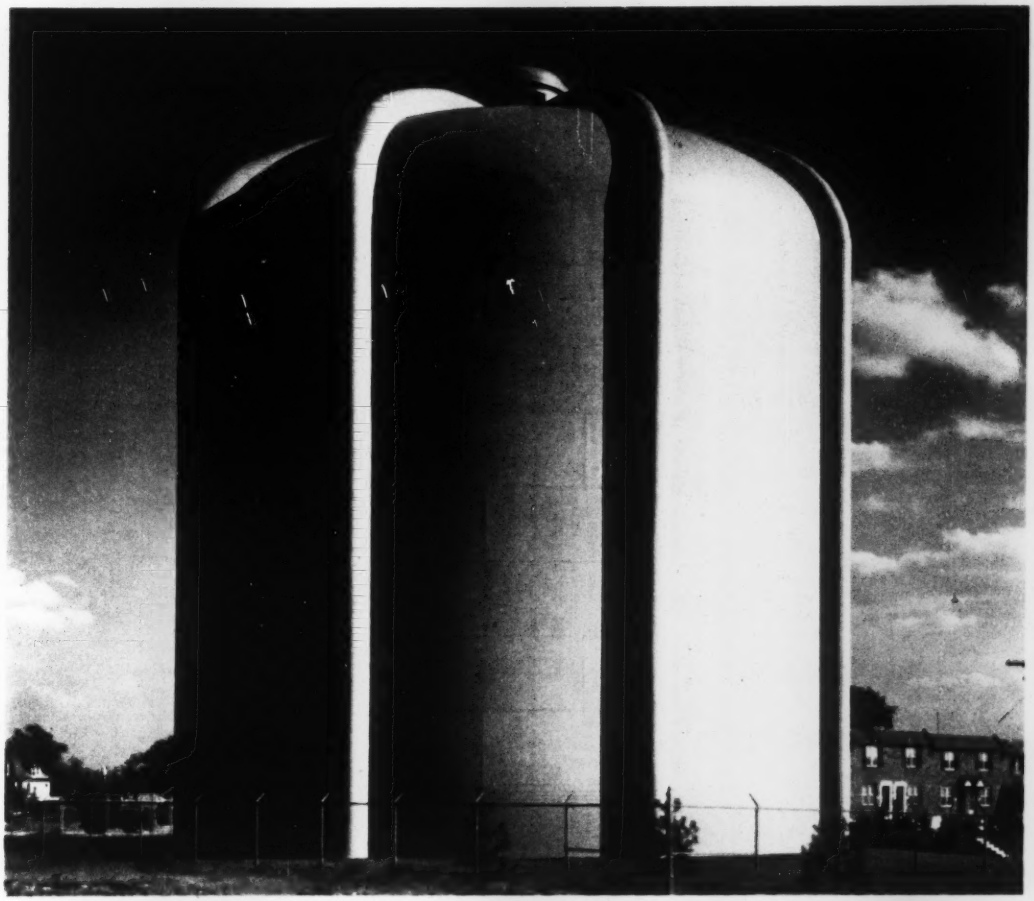
Resistance to abrasive wear of concrete is greatly improved by applying a finish consisting of granular steel particles mixed with equal volumes of cement and floated onto the surface to a depth of .02 in. In a series of tests conducted in the Department of Engineering of the University of California at Los Angeles, W. P. Wallace and T. L. Newton investigated several concrete surface-finishes. The basic mix in the specimens tested was 1:2½:3½, the coarse aggregate being 1½-in. crushed rock. Finishes of calcium chloride, chemical hardener, a surface sealer, fine steel dust, and granular steel particles, were applied to the specimens. The accelerated test consisted of rolling a freely rotating and weighted grinding wheel over the specimens.

After 8 hours of the accelerated test the granular steel finish had worn about .01 in. deep; the other finishes three to four times deeper.



World's Tallest Stone-Storage Silo

This 122-ft-high stone-storage silo, built by Basic Refractories, Inc., as part of its $3,500,000 expansion program at Maple Grove, Ohio, is said to be tallest structure of its kind in the world. Housing twelve bins, silo will store approximately 10,250 tons of No. 6 stone (¾ in.) in eight bins and supplemental raw material in the other four. MacDonald Engineering Company, using slip form technique of pouring concrete, worked round-the-clock under adverse weather conditions to complete silo structure in record eight days. New silo will be fed by cross belt from adjacent silo, which in turn is fed by 735-ft conveyor from stone mill at quarry site. Granular basic refractories produced at plant are used for construction and repair of monolithic basic linings and hearths in metallurgical furnaces.



Modern Design as Applied to Municipal Water Storage

This strikingly modern Horton standpipe was designed, fabricated and erected by the Chicago Bridge & Iron Company for the Philadelphia Water Company at Clifton Heights, Pennsylvania. It clearly illustrates how municipal water storage facilities can be made as attractive in appearance as they are functional in operation — and appearance can be an important factor in residential installations where high property value must be considered.

Horton standpipes and reservoirs are of welded steel construction to assure a long service life with a minimum amount of maintenance. Exterior modifications can be made to meet individual specifications.

Horton reservoirs and standpipes are built in standard capacities up to 10,000,000 gallons. If elevated storage is more advantageous, investigate the advantages of Horton elevated tanks. Tanks with ellipsoidal-bottoms are built in standard capacities from 15,000 to 500,000 gallons. Larger elevated tanks with radial-cone bottoms are built in standard capacities from 500,000 to 3,000,000 gallons. All Horton tanks for municipal water service are built in accordance with American Water Works Association specifications.

More complete information may be obtained by writing our nearest office. Please give capacity, location and height to bottom.

CHICAGO BRIDGE & IRON COMPANY

Atlanta 3 . . . . . 2167 Healy Bldg.
Birmingham 1 . . . . . 1596 N. Fiftieth St.
Boston 10 . . . . . 1099—201 Devonshire St.
Chicago 4 . . . . . 2199 McCormick Bldg.
Cleveland 15 . . . . . 2263 Guildhall Bldg.
Detroit 26 . . . . . 1541 Lafayette Bldg.
Havana . . . . . 402 Abreu Bldg.
Houston 2 . . . . . 2128 C & I Life Bldg.
Los Angeles 17 1556 General Petroleum Bldg.
New York 6 . . . . . 3395—165 Broadway Bldg.
Philadelphia 3 . . 1652—1700 Walnut St. Bldg.
San Francisco 4 . . . . . 1584—200 Bush St.
Seattle 1 . . . . . 1309 Henry Bldg.
Tulsa 3 . . . . . 1647 Hunt Bldg.
Washington 6, D.C. . . . . 1156 Cafritz Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, and GREENVILLE, PENNA.

Use of Explosives for "Sick" Well Cure Reported

Development of a new method of treating "sick" wells that has increased the water yield of the treated wells by as much as 200 per cent was reported at the spring meeting of the American Society of Mechanical Engineers held recently at the University of Washington in Seattle. The improvement in well yield is brought about by the use of vibratory explosives in a process described by Harvey A. Mylander, district engineer for Water Supply Analysts, South Pasadena, Calif. Briefly, the process consists of the use of small explosive charges accurately spaced in the well casing and detonated at calculated time intervals to produce a condition of vibration or continuous shock waves of relatively long duration powerful enough to dislodge obstructions and cleanse the well perforations, permitting greater flow of water from the well.

In an intensive study of well production, Mr. Mylander said, it was found that certain wells in a proven area lost productivity faster than other wells in the vicinity and out of proportion to the decline in the water table. In nine out of ten such wells the reason was stoppage at the perforated area of the well casing, caused in most cases by incrustation, organic growths, or deposits.

Grating Corporation Changes Its Name

The Shelley Steel Corp., of Chicago, announces that it has bought the William F. Klemp Co., also of Chicago, and has changed the latter company's name to the Klemp Metal Grating Corp. Lee Shelley has been elected president of the new corporation.

New Sewage-Treatment Works Planned for Nashville, Tenn.

By recent referendum, the City of Nashville, Tenn., approved the issuance of revenue bonds for the construction of interceptor sewers and a sewage treatment plant to cost approximately $11,000,000. The bonds will be financed by an increase in water rates. Eliminating 26 outfalls now discharging directly into the Cumberland River, the new system will consist of interceptor sewers on each side of the river paralleling the river and forming a junction with the main interceptor, a tunnel section $7\frac{1}{2} \times 8\frac{1}{2}$ ft. All flow in the interceptors will be by gravity to the pumping station at the plant. Designed for primary treatment of an average sewage flow of 40 mgd, with maximum flow of 138 mgd and minimum flow of 15 mgd, the plant will provide disposal facilities for a population of 335,000.

Plans for the project, which have been approved by the Tennessee Department of Public Health, were prepared by the engineering firms of Hart, Freeland and Roberts of Nashville, and Polk, Powell, and Hendon of Birmingham, Ala. Bid calls will be issued by Warren A. Coolidge, M. ASCE, director of public works for Nashville, after arrangements for issuance of bonds and acquisition of rights of way have been completed.

N. G. Neare's COLUMN

R. Robinson Rowe, M. ASCE

"Flo Ridan is a gentleman," proclaimed Joe Kerr.

"You never called me that," protested Professor Neare. "Flo, you're the Guest Professor; you'd better find out what's got into Junior."

"I can guess, Noah. He solved the easy part of dividing a 13-14-15 triangle into 3 component triangles of equal perimeter, didn't you, Joe?"

"Yup, and you were a gentleman until you called it the easy part. It's really the important part. First I drew three circles with centers at the vertices of the triangle and radii 6, 7, and 8 so that each circle was tangent to the other two. Then I drew a big circle circumscribing the three small ones. Its center is the required inside lot corner, and its diameter is the perimeter of the three triangular lots."

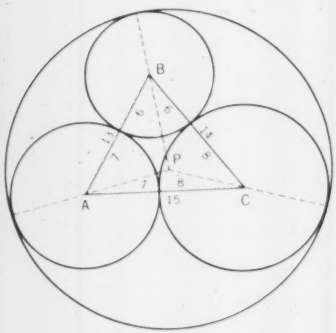


Fig. 1. Joe Kerr's solution is model of circumscription.

"Make Joe prove it," challenged Cal Klater, "and ask him how he drew the big circle."

"Tell Cal, the big bully, to mind his own problem," retorted Joe, "and besides, the big circle is a classical appolonian."

"Touché!" conceded Cal. "My part of the problem was to find the sizes of the three families which were proportional to the areas of the three triangular lots. Using Joe's figure and letting r equal the radius of the circumscribing circle, the lengths of the 3 interior lot lines are $r-6$, $r-7$ and $r-8$. Then using Hero's formula for area of a triangle and the axiom that the areas of triangles APB, BPC and CPA must add to the area of ABC, I derived this equation:

$$\sqrt{42r(r-13)} + \sqrt{48r(r-14)} + \sqrt{56r(r-15)} = \sqrt{21 \cdot 6 \cdot 7 \cdot 8} = 84$$

"Solving for the single unknown, I found $r = 168/11$. The reduction was a bit of a chore, but for a check, substitute this value of r back in the equation and we have the identity:

$$\frac{420}{11} + \frac{336}{11} + \frac{168}{11} = 84$$

from which it is evident that the 3 areas are respectively 5, 4 and 2 elevenths of the original triangle. With propriety, the newlyweds were a family of 2, so the other sisters had families of 4 and 5."

"Sure enuf," chuckled Professor Ridan. "I guess you didn't notice that all dimensions were in chains, so that you could have avoided fractions by converting to feet."

"And I can add a general formula," concluded Professor Neare. "If the radii of Joe's first 3 circles and a, b and c, then

$$r = \frac{abc}{2\sqrt{abc(a+b+c)} - (ab+bc+ca)}$$

and the set-up will be rational if $abc(a+b+c)$ is a square.

"People with triangular lots surely do the craziest things, such as buying such a lot in the first place. I heard of another zany who fenced off a triangular garden so that the three fence corners were each on a different boundary line. Lengths of the boundary sides were 175, 210 and 245 ft; how long did the fence have to be?"

[Cal Klaters were: William C. Hunter, Kum Pecter (Walter Steinbruch), Stoop (John L.) Nagle, Rudolph H. Meyer, Sel Dum (Thomas Borman), Keith Jones, Marvin (Sauer Doe) Larson, H. Francis Finch and Robert E. Phillen. Guest Professor Flo Ridan was Charles G. Edson.]

DECEASED

Former Society Officer, George B. Massey, Is Dead

George Bragg Massey (M. '16) retired civil engineer of Winnetka, Ill., died on March 6, at the age of 76. Following his graduation from Yale University, he was successively employed as assistant to superintendent of Motive Power, Mexican International Railroad, assistant engineer in the U. S. Navy, and assistant engineer for the Bucyrus Co., South Milwaukee, Wis. He was also vice president of the Massey Machine Co., Watertown, N. Y. After two years as a lieutenant in the U. S. Navy during the first World War, he opened a consulting office in Chicago. He was vice president of the Randolph-Perkins Co., from 1921 until his retirement. A specialist in the field of excavation, Mr. Massey is the author of "Engineering of Excavation." He served as an ASCE Director from 1941 to 1943.

George B. Massey

Forrest Nagler (M. '24) who retired March 1 as manager and chief engineer of the Allis-Chalmers atomic power section died suddenly on April 1. He was 66 years of age. Mr. Nagler came to Allis-Chalmers in 1906, the year he graduated from the University of Michigan, entered the hydraulic department in 1908, and advanced to assistant manager of the department in 1920. From 1929 to 1932 he was with the A. O. Smith Corp., Milwaukee, Wis. He returned to Allis-Chalmers and served in Canada as chief engineer; in Milwaukee as chief mechanical engineer; and was named to the atomic power section post in 1949. Mr. Nagler was the inventor of a type of axial-flow high-speed hydraulic turbine runner that bears his name.

John Michael Fitzgerald (M. '47) chief engineer of the Board of Water Supply for New York City since 1948, died in New York on April 1. He was 64 years old. An employee of the board for 45 years, Mr. Fitzgerald spent his career on it except for two years of Army service in World War I. He had been connected in various capacities with such projects as the driving of the Shandaken Tunnel of the Catskill Water Supply System, the construction of the Delaware Aqueduct, the design and construction of Downsville Dam for the Pepacton Reservoir, and the construction contracts for Merriman and Neversink dams. Mr. Fitzgerald was a graduate of Manhattan College.

(*Continued on page 86*)

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strength, economy, appearance!

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Arthur W. Dean, Former ASCE Director, Dies

Arthur Warren Dean (M. '04) retired consulting engineer, died on March 20, at Winchester, Mass. He was 81. In 1896 Mr. Dean was appointed city engineer of Nashua, N.H., resigning after five years to become city engineer on a street railway construction job. In 1904 he became state engineer of the New Hampshire Highway Department. From 1910 until 1935 he served as chief engineer of the Massachusetts State Highway Commission, and then joined the Massachusetts Planning Board as chief engineer. He retired from this position in 1941 at the age of 70. Active in Society affairs, Mr. Dean served on the Board of Direction from 1937 to 1939. He was an alumnus of the Massachusetts Institute of Technology.

Henry Dionysius Fallon (M. '50) district engineer for the U. S. Bureau of Public Roads at Augusta, Me., died there on March 25, at the age of 62. After graduation from Rensselaer Polytechnic Institute and prior to World War I, he was employed successively by the Aluminum Company of America, the Pennsylvania Railroad, and the Massachusetts Highway Commission. During the war he served with the Corps of Engineers at Aberdeen Proving Grounds, Aberdeen, Md., and had been district engineer since 1928. He recently received a citation and Silver Medal from Secretary of Commerce Charles Sawyer, for 31 years "of meritorious service" with the Bureau.

Ernest Albert Cleveland (M. '24) well-known British Columbia engineer and chief commissioner of the Greater Vancouver Water District, Vancouver, B.C., died recently at the age of 77. His experience included work as a railroad engineer, hydraulic engineer, surveyor and town planner. Mr. Butcher served on the Alaskan Boundary Commission in 1894 and 1895, and had represented the Dominion of Canada at three world power congresses.

George Fulton (A. M. '38) president of the Fulton Construction Co., Houston, Tex., died on Jan 11, at the age of 52. From 1925 until 1933, when he became partner in the firm of Fulton & Fulton, specializing in lock and dam construction, Mr. Fulton was associated with Peppard & Fulton Co., Casper, Wyo., and Roger Muller & Sons, Ltd., Montreal, Canada. In 1938 he became president of the Fulton Construction Co., with offices in Superior, Wis. Later Mr. Fulton moved his company to Houston, Tex., where he was concerned with the design of power plants and the design of waterfront facilities in Texas and Louisiana.

Bernard Lincoln Green (M. '01) retired engineer of Cleveland, Ohio, died there on February 28. He was 82. After graduating

with honors from the University of Michigan, Mr. Green worked on the Tampico River jetties and Ferro Carril Nacional del Istmo de Tehuantepec, Mexico. In 1900 he was named secretary of the Osborn Engineering Co., of Cleveland, Ohio, advancing to the position of president by 1930. He was connected with work on plants for the National Carbon Co., at Niagara Falls, N.Y., and Clarksburg, W.Va., the General Tire and Rubber Co., at Akron, Ohio, and the design and construction of many stadiums including the Yankee Stadium and Polo Grounds.

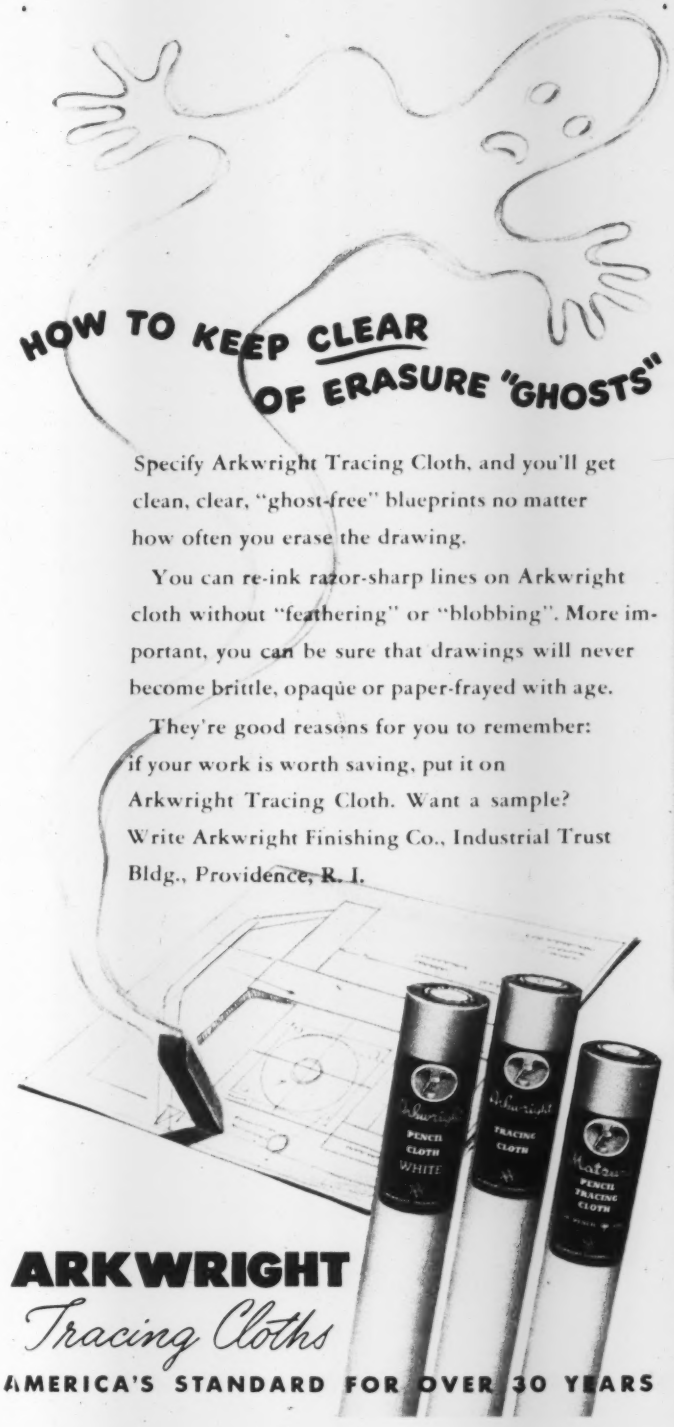
Thomas Worth Marshall (M. '14) partner in the firm of Thomas W. Marshall & James M. Granger, Washington, D.C., died March 28, at the age of 80. In private practice since 1904 (recently inactive), he was responsible for the design of many prominent public and private buildings in the capital and elsewhere, including the new Willard Hotel and Senate wings in the Capitol, and the U.S. Marine Hospital, Staten Island, N.Y. For 35 years he was engineering consultant to the Architect of the Capitol. A graduate of Purdue University, Mr. Marshall worked with the Brown-Ketcham Iron Works, Indianapolis, Ind.; Ritter & Mott, Chicago; and the Anaconda Copper Mining Company, Anaconda, Mont., before going to Washington.

Thomas Marshall

William Laramy Butcher (M. '11) died at his home in West Newton, Mass., on February 27, at the age of 76. A graduate of the Massachusetts Institute of Technology, Mr. Butcher was employed for a time as a civil engineer by the Boston Elevated Railway Co., and the consulting firm of Metcalf & Eddy of Boston. At the time of his death, he was serving in the capacity of treasurer of the Butcher Polish Co., in Boston, Mass.

Richard Charles Sandlass (M. '30) structural steel designer of Baltimore, Md., died on March 22, at the age of 82. After graduating from the Maryland Institute in Baltimore, Md., Mr. Sandlass received the degree of Master of Building Trades from Hochere Landes-Bauschule, Holzminden, Germany. He was chief designer and engineer of structural steel for Campbell & Zell Co., of Baltimore, from 1895 to 1899 and for Bartlett Hayward Co., Baltimore from 1899 to 1904. He then served as chief engineer and general manager of the Chesapeake Iron Works for 19 years, until he entered private practice as a consulting engineer. Since 1926, Mr. Sandlass has been senior member of the firm of Sandlass, Wieman & Associates, Baltimore, Md.

(*Continued on page 88*)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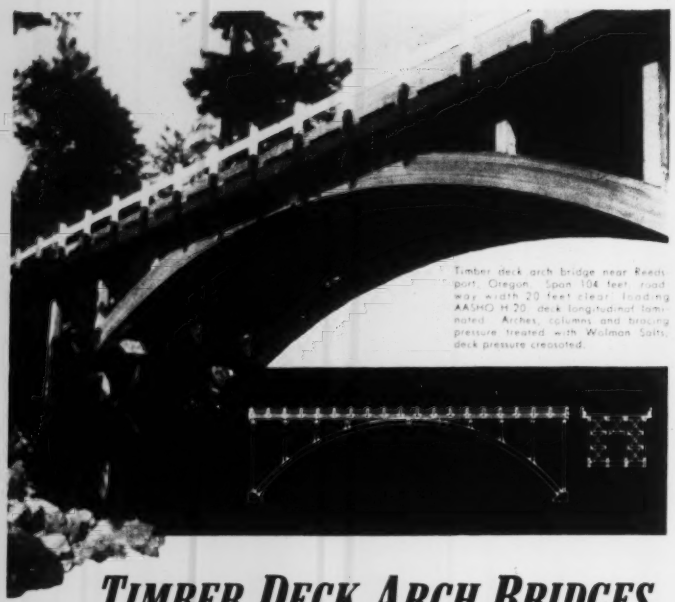

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John Logan Campbell (M. '01), retired railroad engineer of Glendale, Calif., died recently at the age of 89. He began his career in 1888 as deputy county surveyor for El Paso, was elected county surveyor, and then city engineer, before he became a director and chief engineer of the Rio Grande Dam and Irrigation Co., in 1894. From 1895 until he retired as chief engineer for the Northwestern Pacific Railroad in 1931, Mr. Campbell was an engineer with such lines as the Rio Grande, Sierra Madre and Pacific Railway; the El Paso and Northeastern Railway; the Santa Fe Railway; Arizona and New Mexico Railway; the El Paso and Southwestern Railway System; and the Southern Pacific.

Alphonsus Paul McBrady (A.M. '30) of Houston, Tex., died on December 25, 1951, at the age of 66. Mr. McBrady had been employed at various times by the Chicago, Milwaukee & St. Paul Railway; the North Side Land & Water Co., at Wendell, Idaho; the Stone and Webster Corp., at Ft. Worth, Tex.; the Dawson Co., McCone Co., and Garfield Co., all in Montana; and Don Hall of Houston, Tex. At the time of his death, he was connected with the Federal Public Housing Administration as a project engineer.

John Millis (M. '00) colonel, U.S. Army, (retired) died in Cleveland, Ohio, at the age of 94. A member of the Corps of Engineers since 1881, Colonel Millis is credited with planning and installing the light system for the Statue of Liberty, and devising the emergency plan which saved New Orleans in the flood of 1927. At various times he was in charge of offices of the Corps at Cleveland and Chicago, and he also supervised fortifications at Corregidor, and Puget Sound. Colonel Millis was honor man in the West Point class of 1881.

John Gephart Munson (A.M. '40) former vice-president of raw materials of the U.S. Steel Corporation of Delaware, died in Pittsburgh, Pa., on March 29. He was 67 years old, and had served 31 years with U.S. Steel prior to his retirement in 1950. He entered the organization as operating manager of the Michigan Limestone and Chemical Co., and the Bradley Transportation Co., and advanced to president and director of these subsidiaries by 1928. Before his association with U.S. Steel, Mr. Munson had been employed by the J. G. White Engineering Corp., for 10 years. He received his degree from Yale University.

Clifford Thomas Rhoades (M. '40) structural engineer of Boston, Mass., died on March 22 at the age of 51. After graduating from Northeastern University in 1922, he became a designer for J. R. Worcester Co., Boston consulting engineers, for 15 years. Before entering private practice in Boston, he was employed as a structural engineer by Waghorne, Brown Co., Boston; the New England Power Service Co., Boston; and the New England Public Service Co., Augusta, Me. His work included the design of foundations, bridges, and buildings of all types.

Robert Norman Smith, lieutenant, U. S. Army Reserve, was killed in action in Korea, on September 24, 1951, according to information recently received at Society headquarters. He was 26 years old. Lieutenant Smith graduated from the Virginia Military Institute in 1950 and was stationed at Camp Breckenridge, Ky., before going overseas.

Samuel Edwin Stott (A.M. '13) retired engineer of Portland, Me., died there on April 5, at the age of 67. Mr. Stott received his early training with H. P. Converse & Co., the Stone & Webster Corp., the Lockwood & Greene Co., and Swift & Co., all of Boston, Mass. For several years he specialized in waterproofing and refrigerating problems, with his consulting office in New York City. In 1936, Mr. Stott entered government service on the design and construction of airports. At the time of his retirement in 1951, he had advanced to the position of District Airport Engineer for the Civil Aeronautics Administration, at Richmond, Va.

William Kendrick Hatt (M. '13) professor emeritus, founder and former head of the Purdue University School of Civil Engineering, died in Birmingham, Mich., on April 3, at the age of 83. He was a graduate of the University of New Brunswick, and later received the civil engineering degree from Cornell University, where he was awarded the Fuertes Gold Medal. Dr. Hatt joined the Purdue University faculty in 1893 as an associate professor of civil engineering and remained until his retirement in 1939. He served as Indiana state engineer from 1921 to 1939, and was consulting engineer on such projects as Hoover Dam and the Indianapolis War Memorial. He was author of two books on engineering, and a member of the Committee on Building Codes, of the U. S. Department of Commerce, and many other committees.

George Llewellyn Nicolson (M. '94) former president of the District of Columbia Paper Mills, died in Washington, D. C., at 86. He was a graduate of the Virginia Military Institute. He was in charge of the Chesapeake and Ohio Canal from 1891 until its sale to the federal government in 1938. In 1900, he helped organize the paper manufacturing company and became its first president.

Clarence Urling Smith (M. '20, 67 year-old consulting engineer of Los Angeles, Calif., died in February, at Lindsay, Calif. Mr. Smith was employed in various capacities on the construction of railroad bridges in the early part of his career, and during World War I, won the French Croix de Guerre and American citations for bridge building overseas while serving as captain, Corps of Engineers. Mr. Smith served the Milwaukee Harbor Commission as harbor manager and chief port engineer from 1926 to 1941. During that time he made an intensive study of the Great Lakes-St. Lawrence Waterway project and was considered an authority on the subject. From 1944 to 1948 he was construction engineer for the City of Lindsay, and from the latter year, city building inspector. Mr. Smith was an alumnus of Armour Institute of Technology.

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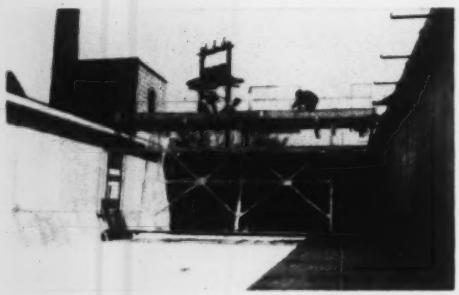
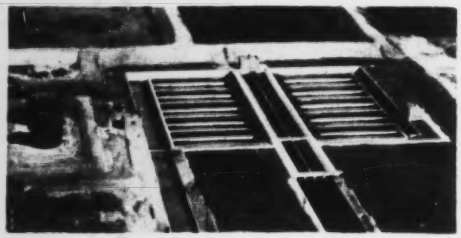


WATER SUPPLY—One of two Hardinge 30' × 100' Clarifiers in a Canadian Municipal water plant. Note sludge scraper and scum skimmer



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Positions Announced

White Sands Proving Ground, Las Cruces, N. Mex. The Civilian Personnel Office announces the availability of positions for electronic scientists with salary ranging from $3,410 to $5,060 a year; electronic engineers, from $4,205 to $5,940 a year; architectural engineers, from $3,410 to $4,205 a year; and physicists and mathematicians. Additional information may be secured by writing to the Ordnance Corps, Civilian Personnel Office, White Sands Proving Ground, Las Cruces, N. Mex.

Engineer Center, Fort Belvoir, Va. Openings for the position of civil engineer with the yearly salary of $4,205 to $5,940, and bridge engineer with a yearly salary of $3,410, are now available at Fort Belvoir, Va. The application for federal employment, standard form 57, must be obtained from a Civil Service Office or Department of the Army Civilian Personnel Office, and mailed or presented in person to the Civilian Personnel Branch, Employee Utilization Section, Building 211, Room 200A, The Engineer Center, Fort Belvoir, Va.

Chief Mechanical Engineer, Burbank, Calif. Applications for the position of chief mechanical engineer for Burbank, Calif., at a monthly salary ranging from $683 to $761, must be presented before June 15. The applicant is required to have an engineering degree and 10 years' experience, including five years in mechanical, civil, or electrical engineering. For further information write to Personnel, City Hall, 275 East Olive Avenue, Burbank, Calif.

Municipal Civil Service Commission, New York. Availability of 68 vacancies for civil engineering draftsmen, at a salary of $3,550 is announced by the Municipal Civil Service Commission. An engineering degree or four years' practical experience are required for the position which entails the making of drawings, layouts and tracings of civil engineering work. Applications are not issued in the mail and must be obtained at the Commission's application section, 96 Duane Street, New York, from 9 a.m. to 4 p.m. and 9 a.m. to 12 noon, on Saturdays. The written test will be held on May 24, 1952.

Solution to problem on page 50

We hope not, since the load on the caves was thereby doubled. Both the rope to the pulley and the one from it carried the full weight of man plus scaffolding. When attached to a point on the scaffolding, each rope carried only half the total weight. The defense had a valid contention.

Non-ASCE Meetings

American Society for Testing Materials. The annual meeting of the American Society for Testing Materials, will be held at the Hotel Statler and Hotel New Yorker, New York City, from June 23 to 27.

Conference of the Western Association of State Highway Officials. Headquarters for the 31st annual conference of the Western Association of State Highway Officials will be the Olympic Hotel, Seattle, Wash., from June 5 to 7.

Society of Automotive Engineers. The summer meeting of the Society of Automotive Engineers will take place at the Ambassador and Ritz Carlton, Atlantic City, N. J., from June 1 to 6. A confidential session on aircraft engines will be held on June 5 and applications for attendance are required.

American Society of Mechanical Engineers. The Semi-Annual Meeting of ASME will be held at the Sheraton Gibson, in Cincinnati, Ohio, June 15-19.

Meetings on Standard International Tests for Iron and Steel. In conjunction with the second triennial General Assembly of the 33-nation International Organization for Standardization, meetings will be held at Columbia University, June 9-12, to discuss standard international tests for iron and steel. The American Standards Association, the U. S. member of ISO, is acting as host.

Conference on Nuclear Energy. A conference entitled "Atomic Energy and the Future," will take place in the Kellogg Center, Michigan State College, East Lansing, Mich., on May 20 and 21. Sponsors are the Department of Mechanical Engineering and the Continuing Education Service of the college.

Society for Experimental Stress Analysis. The Society for Experimental Stress Analysis will meet at the Hotel Lincoln, in Indianapolis, Ind., May 14-17.

American Institute of Chemical Engineers. The American Institute of Chemical Engineers will hold its spring meeting at the French Lick Springs Hotel, French Lick, Ind., May 11-14.

UPADI. A meeting of the UPADI (Union Panamericana de Asociaciones de Ingenieros) will be held in New Orleans, La., August 26-30. The UPADI special committee of United States engineers appointed to work out final plans for the meeting consists of J. M. Todd, chairman; E. A. Pratt, vice-chairman; S. E. Reinel, secretary.

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CIVIL ENGINEER. J. M. ASCE. 26, married. B. S. in C. E. June 1949, registered. 3 years experience in supervision of construction and survey work. Desires responsible position in construction or consultant field with reliable concern; will consider position involving travel or overseas employment. C. 741.

CIVIL ENGINEER. J. M. ASCE. 31, married, graduate civil engineer with architectural option. 3 year's experience in building design and municipal improvement projects office and field. 10 months experience in aircraft industry. 3 years as naval pilot. Desires position with consulting engineer or contractor. C. 742. 523 A 12 San Francisco.

CIVIL ENGINEER. J. M. ASCE. 29. MC E. 47 Cornell. Tau Beta Pi. business administration course. Alexander Hamilton Institute registered engineer California. 1 year teaching. 5 years design and administration experience with a major oil company. 2 years airbase design and construction U. S. Army. Desires position in sales, production or teaching. C. 743. 523 A 22 San Francisco.

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SENIOR ASSISTANT SANITARY ENGINEER, graduate with degree in chemistry or sanitary engineering and 4 years experience in chemistry or sanitary engineering of industrial or municipal waste disposal. Position involves the performance of responsible sanitary engineering work in developing and applying public health sanitary engineering and water pollution control measures. Salary $4,149-$5,175 a year. Location Maryland. Y 6248.

RECENT GRADUATES civil or mechanical engineers, who are interested in construction work. Will be required to work in office and be trained for heavy construction work in the field. Domestic or foreign. Salary $4,200 a year. Headquarters New York, N.Y. Y 6266.

ENGINEERS. (a) Water Works Engineer seeks experienced in operation, management and construction of water utility plants, to direct hydraulic studies and design for improvements as well as direct supervision of operation. (b) Junior Engineer, recent civil graduate interested in water works utility plant. Salaries open. Location New York State. Y 6604.

CIVIL ENGINEER, experienced in water supply and/or dam design studies and reports. Location Pennsylvania. Y 6607.

CIVIL ENGINEER, graduate with 3 years experience in drafting and design of structural details or any equivalent combination of education and experience with a maximum substitution of 2 years experience for 2 years of college unless a registered professional engineer. Salary $4,576-$5,460 a year. Location Virginia. Y 6629-3.

CIVIL ENGINEER, graduate with at least 8 years design and field experience on waterfront construction, pumphouse, office building, tank foundations, to design bulk terminals with occasional field inspection work. Salary $6,000-$8,000 a year. Location New York, N.Y. Y 6647.

CONSTRUCTION SUPERINTENDENT, civil graduate 35-45 with at least 5 years field engineering and supervisory building construction experience, to take charge of housing projects, hospitals etc. for general contractor. Salary $6,000-$9,000 a year. Location Panama and Caribbean area. Y 6655.

PROFESSOR IN CIVIL ENGINEERING, graduate, to head civil engineering department. Teaching experience in the field of structures and applied mechanics preferred. Salary $6,000-$7,500 a year. Location Virginia. Y 6690-(a).

CONSTRUCTION PROJECT ENGINEER, under 35 with degree in architectural or construction engineering to review plans and specifications for construction projects as well as to recommend architectural styles and types of construction for overseas operations. Will develop recommendations regarding changes in designs of layouts and also will be concerned with material costs, inspection and appraisal, etc. Some traveling to overseas plants for inspection, appraisal, etc. Should have some head office experience with one of the major construction companies. Salary open. Headquarters Pennsylvania with traveling to Canada, Australia, England and Spain. Y 6694.

ARCHITECTURAL ENGINEER, preferably with 5 years experience in institutional building layout particularly hospital work. Salary $7,500-$9,000. Location Connecticut. Y 6696.

CIVIL ENGINEERS. B.S. degrees, 6 months to 1½ years experience in civil engineering. Applicants with M.S. degrees will be allowed full credit for the 6 months of required experience. Assignments will entail field and office work on new construction and modifications. Salaries $4,205-$5,060 a year. Location, Connecticut. Y 6701.

MECHANICAL, STRUCTURAL OR CIVIL ENGINEERS, preferably graduates with 10 years minimum office experience in designing and preparing working drawings of reinforced concrete steel framed industrial buildings and structures. Experience in preparation of cost estimates, construction specifications for industrial buildings and process equipment installation desirable. Will do general planning of building additions, changes and major repairs for industrial plants. Prepare complete working drawing of industrial buildings and structures of reinforced concrete steel frame or frame construction. General planning and preparation of working drawings of process equipment installations. Preparation of cost estimates and construction specifications. Field supervision and inspection of building construction and equipment installation. Location Washington State. Y 6723.

PROJECT MANAGER AND DESIGNER 38-45, civil graduate with at least 10 years experience in architects or consulting engineers office covering design of commercial, industrial and institutional buildings. Salary $7,500-$8,500 a year. Location Washington State. Y 6748-(b).

ASSISTANT SUPERINTENDENT OF PUBLIC WORKS, preferably with N. Y. State P. E. license for field and office supervision of construction and operation of municipal projects. Salary $4,600 a year. Location, western New York State. Y 6754.

CONSTRUCTION FIELD ENGINEER, 30-50, with heavy industrial construction experience to supervise field layout of foundations, reinforcement, structural steel, etc. Salary, $7,800 a year plus bonus. Location, Chile, South America. Y 6755-(a).

HIGHWAY ENGINEER with experience in design of construction and planning of traffic research, statistics and reports to direct engineering, covering surveys, tabulations, reports, etc., for technical association. Salary open. Location, Washington, D. C. Y 6765.

FOUNDATION ENGINEER with 10 years experience designing heavy foundations and bridge piers. Advanced degree in structures desirable. Knowledge of soils mechanics essential. Capable of departmental responsibilities in small organization. Location, East. Y 6776.

CIVIL ENGINEERS, experienced in hydrology and hydraulic design, for surveys, studies and design with public authority. Location, Pennsylvania. Y 6780.

CIVIL OR STRUCTURAL ENGINEERS recent graduates with degrees for work including determining of structural and architectural requirements, preparing working drawings, specifications and estimating for construction of power plants, subways, wharves, subaqueous tunnels, wind tunnels, transmission towers and industrial structures. Must be capable of doing structural design work. Will be given drafting and design assignments in connection with various projects. Salaries open. Location Massachusetts. Y 6803.

ENGINEER. (a) Structural Designer, with 7 to 10 years experience to supervise checking and shop drawings of concrete and steel on heavy construction. (b) Estimator with highway experience. Must have good solid background on heavy construction estimating. Building construction not satisfactory. (c) Highway designer with 2 to 4 years experience. Salaries open. Location, New York, N.Y. Y 6807.

EXECUTIVE ASSISTANT TO GENERAL MANAGER 28-35, degree in civil or industrial engineering with minimum of 5 years practical experience 2 of 4 years experience in executive capacity, preferably in manufacturing or purchasing of building supplies. Would be expected to negotiate contracts and subcontracts. Any experience in construction desirable. Salary $6,000-$7,500 a year. Location New York, N.Y. Y 6817.

SANITARY ENGINEER, with at least 3 years experience in sewer and water works design and construction. Immediate assignment as resident engineer on large sewage treatment plant. Salary dependent upon experience and ability. Location, Michigan. Y 6828.

STRUCTURAL DESIGNER, 40-50, with broad concrete structure experience covering buildings, bridges, storage, etc. Salary $8,000 a year. Location, New York, N.Y. Y 6845.

DESIGN ENGINEER, civil, with 3 to 5 years experience in the design of small dams, irrigation systems, structures and foundations. Duration 1 year to 18 months. After 3 months may take family at company expense. Salary, $10,800 a year. Location, Peru. Y 6847.

CIVIL ENGINEERS. (a) Civil Engineer, graduate, who has had some municipal experience particularly on streets and sewers. Salary $5,800-$7,000 a year. (b) Junior Civil Engineer, graduate

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Expansion of refining facilities creates an immediate need for trained technical men. Opportunities are open to qualified recent graduates and experienced engineers in one of the leading companies in an industry that is noted for its engineering achievements.

Positions are permanent and well-paying, with excellent opportunities for advancement. Outstanding employee benefit plans are provided.

The interesting variety of work includes inspection of existing oil refining units and of new facilities; also the design, construction, development and servicing of all types of oil refinery equipment. This includes power plants and distribution systems, water supply and waste disposal facilities, structures, buildings, heat exchangers, piping, fractionating and other process equipment used in the development and distribution of petroleum products.

Opportunities in Engineering and promotional outlets to other departments of the Company.

Reply by letter, giving detailed information on education, experience, and salary expected. All applications will be carefully considered and kept strictly confidential.

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ate with about 1 year's experience in general civil engineering and some knowledge of streets and sewers. Salary $2,880-$3,600 a year. Must be residents of northern New Jersey. Y-6856.

Graduate Assistants for research projects in hydraulics, hydrology, soil mechanics and structural engineering. Half of time will be spent in research work and the other half in graduate work making it possible to secure master's degree in 2 years. Positions start September 16, 1952. Salary $1,740 for 9 months' half time service. Location Connecticut. Y-6907.

Superintendent, 30-35 with 3 years experience in concrete pipe design and manufacturing knowledge of reinforced concrete. To supervise production of concrete pipe and allied products. Salary $6,000-$7,000 a year. Employer will negotiate fee. Location, Middle West. R-8777.

Special Assistant to Director of Installations with broad background of experience preferably in civil or construction fields, plus executive and staff management experience. Duties will include construction coordination, program development, material allocation. Salary $13,000 a year. Location Washington, D. C. Y-6902.

Assistant Superintendent to Field Engineer with at least 5 years commercial and apartment house construction experience, to give line and grade and supervise sub-contractors on two story store and suburban apartment project. Salary, $6,500 a year. Location, Long Island, N. Y. Y-6923.

Assistant Professorship, civil engineer, 33-38, with 2 years experience in surveying and mapping. Will instruct in surveying and mapping and other undergraduate civil engineering courses. Salary open. Location, Illinois. T-8706.

NEWS OF ENGINEERS

ASCE Past President Franklin Thomas (right) receives fourth annual Construction Industries Achievement Award from Paul C. Keenan, chairman of selection jury, at banquet sponsored by construction industries committee of Los Angeles Chamber of Commerce. Dr. Thomas, dean of students, California Institute of Technology, was cited as "having done most to further the interests of the industry and entire community through training minds of men."

Thomas A. Currie, Jr., was recently elected vice-president and construction manager of United Engineers & Constructors Inc., Philadelphia, Pa.

Herbert M. Bosch, professor of public health engineering at the University of Minnesota, recently was appointed to the Minnesota State Board of Health by Governor **C. Elmer Anderson.**

Theodore Belzner was honored at a recent testimonial reception held at the Brooklyn Bridge by the employees of the Division of Bridges. Mr. Belzner, who is retiring after 52 years in the city service, was presented with a scroll and a gold watch by Public Works Commissioner, **Frederick H. Zurmuhlen.**

Howard V. Canan, colonel, has been assigned to a newly created post as Engineer Inspector General in the Office of the Army Chief of Engineers.

Wharton Green and **E. J. Carrillo** of the firm of Downer, Green & Carrillo, having completed the design and supervision of construction of the hydraulic fill, runways and utilities of the Idlewild Airport, are liquidating. Also in the process of liquidation is Carrillo & Green Associates, consultants for the Port of New York Authority on the Idlewild and Newark Airports.

William A. Goodwin has accepted a position as assistant research engineer on the Tennessee Highway Research Program, at Knoxville, Tenn. Previously, he held a similar position with the Highways Materials Research Laboratory of the State of Kentucky.

Matsuyoshi Arashiro has transferred from the U. S. Bureau of Reclamation Hungry Horse Project to the Corps of Engineers at the 4th Air Force Base in Topeka, Kans.

Frederick P. Witte has resigned as engineer for the U. S. Bureau of Reclamation on the Hungry Horse project to accept a position with Giffels & Vallet, Engineers and Architects of Detroit, Mich., at their Paducah, Ky., project.

E. O. Griffenhagen announces that his firm, Griffenhagen & Associates of Chicago, has been retained by the Committee on City Expenditures, authorized by the Chicago City Council, to make a study of the opportunities for economy or improved service in four departments of the Chicago city government. **Stanley I. Pinel,** principal engineer, who recently completed a similar assignment for the firm in San Francisco, is participating in the study.

John J. Forrer of Harrisonburg, Va., has resigned as assistant chief engineer of the Virginia Department of Highways, with which he was associated for 35 years, to become executive director of the Virginia Asphalt Association, Inc., Richmond, Va.

Emil A. Gramstorff, professor and chairman of the department of civil engineering, at Northeastern University, Boston, Mass., was elected president of the Boston Society of Civil Engineers at the 104th annual meeting of the society. Other officers elected for the coming year are: Chester J. Ginder, vice-president; Robert W. Moir, secretary; Charles O. Baird, treasurer; and Leslie J. Hooper, James F. Brittain and Edwin B. Cobb, directors.

Roderick L. Downing (center) professor of civil and architectural engineering at University of Colorado, examines scroll signed by 45 Colorado officials and honoring him as "Father of the Boulder-Denver Turnpike." Looking on are Warren Raeder (left) of university staff, and Robert Livingston, of Colorado Highway Department. Photo courtesy of F. G. Walters, Univ. of Colo.

Harry R. Hartman, chief engineer for the Witco Chemical Co., has been transferred from the company's Chicago office to their New York office.

Hugh Jones is now affiliated with the Hood Construction Co., of Lynwood, Calif., as manager of the general construction division.

Franklin T. Matthias is associated with the Aluminum Company of Canada, in Vancouver, B.C., as assistant manager of their British Columbia project. Previously he was connected with the Paraiba-Pirai project in Rio de Janeiro, Brazil.

(Continued on page 96)

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Paul A. Jones is retiring as head of the Construction Administrative Division of the Bureau of Reclamation at Denver, Colo., after 37 years with the Bureau. His many irrigation and reclamation assignments have included the Umatilla Project, the Shoshone Project, and the Kittitas Division of the Yakima Project. He has also been chief inspector on construction of Hoover Dam and resident engineer on the Gila Project, and was in charge of investigations and preliminary work on the Hungry Horse Dam.

Paul A. Jones

Wesley E. Gilbertson, formerly with the U. S. Public Health Service in Atlanta, is now chief of the Division of Civilian Health Requirements for the same service in Washington, D. C.

Walter S. Douglas and **Alfred Hedefine** have been made partners in the consulting engineering firm of Parsons, Brinckerhoff, Hall & Macdonald, of New York.

George D. Whitmore has been elected president of the American Society of Photogrammetry. **Alfred O. Quinn** is first vice-president, and **Ford Bartlett**, second vice-president.

Asrar A. Qureshy has been placed in charge of the Pakpattan Canal's Eastern Bar Division at Pakpattan, Punjab, Pakistan. His work will consist chiefly of channel maintenance and assessment of water rates and land revenue.

Emerson C. Itschner, colonel, Corps of Engineers, has been assigned as North Pacific Division Engineer at Portland, Oreg. Colonel Itschner has been Army Engineer for the Fifth Army, Chicago, since November 1951 when he returned from service in Korea. He has been in the Corps of Engineers 28 years.

B. S. Merrill and **O. Clarke Mann**, consulting engineers, announce the formation of a partnership, Merrill & Mann, with headquarters in Memphis, Tenn.

Reginald V. Millbank, associate professor of civil engineering at the University of Vermont has been named acting chairman of the civil engineering department. Before joining the faculty in 1946, he spent four years with the Bethlehem Steel Co., and two and a half years as a lieutenant commander in the U. S. Navy.

Howard Eugene Moses consultant chief engineer for the Pennsylvania State Department of Health, Harrisburg, Pa., has been appointed Pennsylvania member on the Ohio River Valley Water Sanitation Commission.

William H. Rayner, professor of civil engineering at the University of Illinois, announces his retirement effective September 1, 1952.

Seelye Stevenson Value and Knecht, consulting engineers of New York City, announce the opening of a new office in Washington, D. C., with **T. Malcolm Price**, executive engineer, in charge.

Harold F. Sommerschield is now associated with Alell-Howe Co., Chicago engineers and contractors, in the capacity of chief engineer. He was formerly employed as structural field representative of the Chicago District Office of the Portland Cement Association. Mr. Sommerschield is a director of the Illinois Section.

Douglas McHenry, formerly head of the Concrete Laboratory Section of the Bureau of Reclamation in Denver, Colo., has been appointed administrative assistant to **A. Allan Bates**, vice president for research and development of the Portland Cement Association.

The firm of **Greer & McClelland**, consulting engineers of Houston, Tex., announces the opening of an office at Montclair, N. J. They will continue to practice in the specialized field of soil mechanics and foundation engineering under **David M. Greer**, as resident partner.

Salem Spitz has been promoted to the grade of corporal at the Heidelberg Military Post in the U. S. Zone of Germany. A 1948 graduate of the City College of New York, Mr. Spitz was stationed at Fort Belvoir, Va., before his assignment to Germany in August 1951.

Moses E. Cox, immediate past president of the Georgia Section, has been appointed consulting engineer for the Georgia Turnpike Commission. He will continue handling the work of the Atlanta Expressway system.

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PRESENT YOUR PLAN FORCEFULLY

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L. E. Grinter, since 1946 research professor of civil engineering and mechanics at the Illinois Institute of Technology, has accepted appointment as dean of the graduate school and director of research at the University of Florida. He will take up his new duties at the beginning of the fall semester. Dr. Grinter went to Armour Institute of Technology in 1937 to organize the graduate school and serve as its first dean. With the merger of Armour and Lewis institutes, he became the first vice-president of Illinois Tech and was responsible, from 1940 to 1946, for its coordinated educational and research program. Dr. Grinter was active in organizing and first chairman of the ASCE Engineering Mechanics Division.

L. E. Grinter

Frederick A. Dale, consulting engineer of Cashiers, N. C., is in Brazil on a three-month assignment for Burns and Roe, Inc., of New York. His work will consist of consultation on hydroelectric development for the State of Parana, Brazil.

James M. Gere, a member of the faculty of Rensselaer Polytechnic Institute, has been awarded a National Science Foundation pre-doctoral fellowship, which will permit him to engage in full-time study for his doctorate, in the next two years. Mr. Gere is a recent CIVIL ENGINEERING author.

James N. Maples has joined the Richmond Concrete Products Co., of Augusta, Ga., as executive vice president. Former vice president and general manager of Superior Concrete Products in that city, he will be in charge of general plant operations and sales in his new capacity.

Alfred C. Marane, construction engineer with the Savannah District of the Corps of Engineers, is now employed by Chas. T. Main Inc., Boston, Mass., as construction engineer in charge of construction of the Sariyar Dam, powerhouse and tunnel, in Turkey.

Kenneth M. Smith, for the past two years chief of the Construction Division of the Fort Worth District of the Corps of Engineers, has been reassigned as chief of the Engineering Division. In his new capacity he replaces **Lt. Col. Clayton B. Lyle, Jr.,** who has been named military assistant to the District Engineer.

Thomas G. Harton, Lieutenant colonel, Corps of Engineers, has assumed new duties as post engineer at Redstone Arsenal, Huntsville, Ala. Colonel Harton was assigned to the Ordnance Corps key guided missile and rocket arsenal after serving as executive officer for the repairs and utility of the Engineer Section, Third Army Headquarters, Atlanta, Ga.

Denver Convention of ASCE
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RECENT BOOKS

Design of Insulated Buildings for Various Climates

Part I of this book by Tyler Stewart Rogers provides simple explanations of the principles which determine the proper construction of buildings to cope effectively with climatic problems. Part II is a working manual of recommended practices in heat and vapor control and structural ventilation, dealing with practical designs for insulated roofs, ceilings, walls and floors. Design tables give basic data for solving most of the problems encountered by builders. Recommendations are related to the major climate zones in the United States in order to give equal help for all locations. (An Architectural Record Book. F. W. Dodge Corp., New York, 1951. 119 pp. $5.50.)

Graphic Aids in Engineering Computation

Covering a wide range of graphical and mechanical methods, this text by Randolph P. Boehecker, Joseph Norman Arnold, and Stanley H. Pierce, includes chapters on the standard slide rules, the derivation of empirical equations from laboratory or field data, the construction of nomographs by geometric methods and with determinants, the construction of special slide rules, graphical differentiation, and moveable-scale nomographs. Basic facts are stated, detailed instructions are presented, and the student's understanding of the subject is extended and tested by representative groups of problems. (McGraw-Hill Book Co., New York, 1952. 167 pp. $4.50.)

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Structural Theory and Design. Vol. 2

The second volume of this two volume set by J. McHardy Young deals with advanced theory and design suitable for the student specializing in structures and for the practicing structural engineer. The aimed at balance between theory and practice is evidenced in the worked out problems. The following subject matter is dealt with: redundant framed structures, portals and rigid frames, arches, effects of wind pressure, earth pressures, foundations, structural connections, and miscellaneous structural problems. (Crosby Lockwood and Son, Ltd., London, 599 pp., 25s.)

Triaxial Testing of Soils and Bituminous Mixtures

The thirteen papers included in this symposium were presented at two national meetings of the A.S.T.M. in 1949 and 1950. They present highly detailed treatments of various aspects of the methods used, the equipment involved, and specialized applications. The papers are extensively illustrated with charts, diagrams, and photographs to facilitate the practical application of the information presented. (Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 303 pp., $3.50.)

Man the Maker: A History of Technology and Engineering

The history of man's scientific progress, correlating the close bond between pure science, engineering and technology, and parallel social and economic growth, is presented in a single volume by R. J. Forbes. The book discusses in turn the technical contributions of each of the great periods of human history, covering a span from the Stone Age to the modern era and stressing the unified efforts of all nations and peoples. Dangers inherent in the present age, where scientific progress has far outstripped social progress, are pointed up in the epilogue. (Henry Schuman, Inc., New York, N.Y., 1950. 455 pp., $4.)

Buckling Strength of Metal Structures

This latest addition to the Engineering Societies Monographs list, by Friedrich Bleich—with the collaboration of Commander Lyle B. Ramsey, U.S.N. and edited by Hans H. Bleich—presents an extensive analysis of the behavior of fabricated steel structures under compression loading especially applicable in structural and ship design. Covering a wide range of subjects from the buckling of columns to stability of web plates and special problems in the design of ship plating, the book presents practically applicable methods, formulas, tables, and graphs. The many footnotes and additional lists of references reflect the breadth of the literature surveyed in addition to the original work included. (McGraw-Hill Book Company, New York, 1952. 508 pages. $10.)

Industrial Water Pollution

The essential aspects of the laws and regulations of the several states and territories have been extracted in this "survey of legislation and regulations," by Marvin D. Weiss, especially with respect to the effect of the laws upon industrial establishments. The Federal Standard Legislation governing water pollution is discussed in some detail, as are also the activities of the various Interstate Agencies. Where standards of water quality have been adopted these are given in their entirety. (Chemonomics, Inc., 400 Madison Avenue, New York 17, N.Y., 1951. 142 pp. $3.)

Wood Preservation, During the Last Fifty Years

Wood preservation is considered by the authors, H. Broese Van Groenou, H. W. I. Rischen and J. Van Den Berge to be the means of preventing attack by living organisms. These organisms are discussed in Part A under the headings of fungi, insects, and

marine borers, and methods of preservative treatment are also covered. Part B deals in detail with the preservative oils and compounds themselves. Part C lists the research institutes concerned with the subject and gives evaluations of the various preservatives. Extensive reference lists are provided, corresponding to notations in the text. (A. W. Sijthoff's Uitgeversmaatschappij, N.V., Leiden (Holland), 1951. 318 pp., $6.)

Plane Table Mapping

A manual for geologists, civil engineers, and foresters, as well as a college text, this book by Fultan W. Low describes in detail the plane table methods by which a field survey is carried out from its inception to the finished map. Space is devoted to the care and adjustment of surveying instruments, characteristics of aerial photographs, drawing instruments and the finished drafting of maps, and various useful data tables. (Harper and Brothers, New York, 365 pp., $4.50.)

Soil Engineering

Written for the beginner in the field, this book by Merlin Grant Spangler, should be useful to undergraduate students and practicing engineers who have not had formal training in soils. Some of the chapters are on the nature of soil, structure and texture, density, water in soils, engineering soil classification, frost action, thickness of flexible pavements, stress distribution, stability of slopes, embankments, levees, earth dams, pressure on retaining walls, piles, and underground conduits. (International Textbook Co., Scranton, Pa., 1951. 458 pp., $6.50.)

Applications for Admission to ASCE, March 15–April 5

Applying for Member

FRANK EVERETT BAXTER, Redding, Calif.
HERBERT GRANT BOSSY, Washington, D.C.
ARTHUR STANLEY BROCK, Chicago, Ill.
CHARLES CARTER BROWN, Baton Rouge, La.
ABRAM CLARK, Baltimore, Md.
HORACE CUSHMAN CRANDALL, Wolfeboro, N. H.
STEPHEN HAROLD DROTTAR, Auburn, Me.
WILLIAM RILEY DYER, St. Louis, Mo.
VAUGHN BEVERIDGE EVERETT, Augusta, Me.
CARL EMERSON FRITTS, Washington, D.C.
CECIL HAUBER, Angola, Ind.
WILLIAM STENINGER KLOCKENTEGER, Juneau, Alaska.
DUDLEY M. MEYER, Chicago, Ill.
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ADAM GEORGE MUNDINGER, Baton Rouge, La.
CLARENCE LESLIE PARTRIDGE, Augusta, Me.
ARTHUR CROYLE RADER, Helena, Mont.
WILLIAM LESTER RICHARDS, Great Lakes, Ill.
TRUMAN HENRY SAFFORD, Boston, Mass.
KYATSANDRA SEETHARAMIAH, Bangalore, S. India.
ALBERT HOULETTE SCHAEFER, Pittsburgh, Pa.
KARL VERNON TAYLOR, Kansas City, Mo.
GEORGE LEE WRY, Winthrop, Mass.

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ONOFRE RANSON BANSON, Ithaca, N.Y.
CHARLES EMMETT BROWN, Tucson, Ariz.
JORGE ARIAS DE BLOIS, Guatemala City, C.A.
JOSEPH ROBERT DILLON, Chicago, Ill.
HAROLD SUMNER FOX, Boston, Mass.
ALLEN ISRAEL GREEN, Washington, D.C.
CHARLES WILLIAM HALLSTROM, Pasadena, Calif.
CHARLES ROY HINE, Hamilton, Ohio.
ANTHONY HOMYK, Indianapolis, Ind.
SYED SHAUKAT HUSSAIN, Lahore, Pakistan.
HENRY JAY IACOBY, New York, N.Y.
CLARENCE COLLINS KING, Atlanta, Ga.
THOMAS ROBERT KYPER, Ellwood City, Pa.
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FRANK CHARLES LUPO, Augusta, Ga.
LAWRENCE THEODORE MARINER, Los Angeles, Calif.
ROBERT PEARSON MARSHALL, Chicago, Ill.
ABUL MAJID ZAHIRUL HAQUE MAZUMDER, Dover, Del.
HERBERT DAVID MCDUFFEE, Milwaukee, Wis.
ALBERT HOWARD MCQUISTION, Cleveland, Ohio.
ALTON G. NEELLEY, Houston, Tex.
WILLIAM BREA PIERCE, Topsham, Me.
PAUL CLYDE SANDY, Muscatine, Iowa.
MYRON MOREDGE SMITH, SR., Norfolk, Va.
JOHN NELSON STRANGE, Vicksburg, Miss.
RUDOLPH SZILARD, JR., New York, N.Y.
HAROLD MARTIN TAPAY, Santa Clara, Calif.
SAUL UDWIN, Salisbury, Southern Rhodesia.
WILLIAM ALEXANDER WATSON, Tampa, Fla.

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SAM BLOCK, Saskatoon, Canada.
MARIO CAMPO, Gainesville, Fla.
JOHN COOK, Watertown, N.Y.
CARL EDWARD CRONE, Washington, D.C.
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TAKEO FUJII, Honomu, Hawaii.
KWEKU ATTA GHARTEY, San Juan, Puerto Rico.
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GEORGE ANDREW PEQUET, Butler, Wis.
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ROBERT LOUIS REISINGER, JR., Milwaukee, Wis.
JOHN GUSTAF FRANCIS ROUSSET, San Francisco, Calif.
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JOSEPH CLYATT THORNTON, JR., Birmingham, Ala.
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WILLIAM HARRY WALKER, Louisville, Ky.
BERTRAM SAUL WARNHAW, Augusta, Ga.
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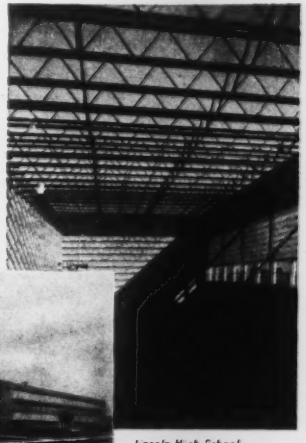
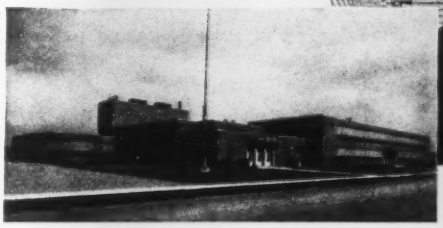
ROBERT MCFERRAN WINTER, Padacuh, Ky.
CIRVAL LEO WOODARD, Sacramento, Calif.

[Applications for Junior membership from ASCE Student Chapters are not listed.]

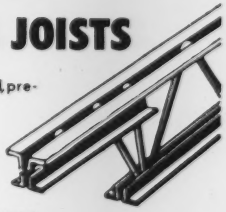
for STRENGTH / ADAPTABILITY / ECONOMY





Lincoln High School
East St. Louis, Illinois
Contractor: Ford Ganschinietz
Architect: S. T. Pabst

Specify LACLEDE STEEL JOISTS



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ADAPTABLE—Laclede Steel Joists combine efficient structural function with architectural versatility.

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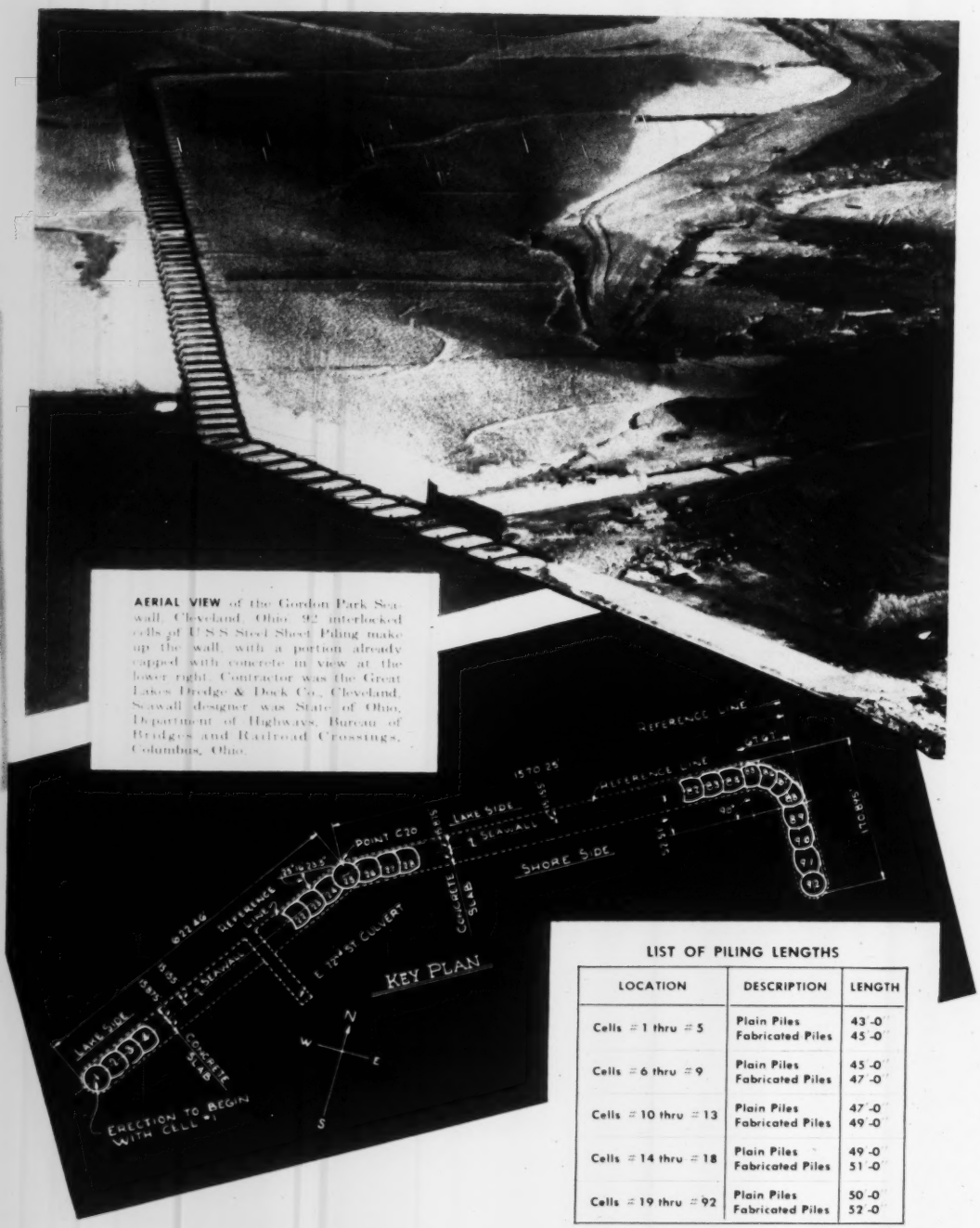
Producers of Steel for Industry and Construction
LACLEDE STEEL COMPANY
St. Louis, Mo.

92 cells of U·S·S Steel



AERIAL VIEW of the Gordon Park Seawall, Cleveland, Ohio. 92 interlocked cells of U·S·S Steel Sheet Piling make up the wall, with a portion already capped with concrete in view at the lower right. Contractor was the Great Lakes Dredge & Dock Co., Cleveland. Seawall designer was State of Ohio, Department of Highways, Bureau of Bridges and Railroad Crossings, Columbus, Ohio.

LIST OF PILING LENGTHS

LOCATION	DESCRIPTION	LENGTH
Cells # 1 thru # 5	Plain Piles	43'-0"
	Fabricated Piles	45'-0"
Cells # 6 thru # 9	Plain Piles	45'-0"
	Fabricated Piles	47'-0"
Cells # 10 thru # 13	Plain Piles	47'-0"
	Fabricated Piles	49'-0"
Cells # 14 thru # 18	Plain Piles	49'-0"
	Fabricated Piles	51'-0"
Cells # 19 thru # 92	Plain Piles	50'-0"
	Fabricated Piles	52'-0"

Sheet Piling

FORM NEW GORDON PARK SEAWALL AT CLEVELAND

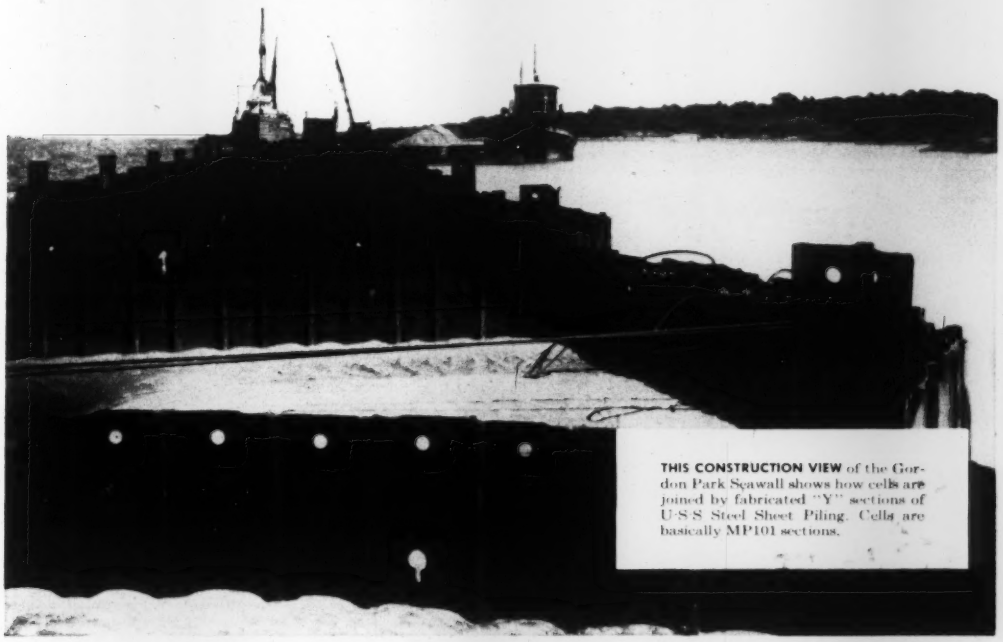
TO protect Cleveland's Lake Boulevard from the frequent and severe storms that lash Lake Erie, a new seawall is being constructed in the Gordon Park area. It is made up of 92 cells of U·S·S Steel Sheet Piling to be capped with concrete.

Ground level is exceptionally low at this point and soil conditions vary from sandy clay to stiff clay. The U·S·S Steel Sheet Piling, in average lengths of 49 feet, is being driven to a penetration depth of 20 feet.

The seawall, approximately one-half mile in length, is using a total of 4,440 tons of MP101 piling sections, along with 240 tons of fabricated "Y" piling sections.

Wherever you want to keep earth and water in place, U·S·S Steel Sheet Piling offers you the double advantages of speed and economy. It is an easily-installed construction that is strong, rugged and lasting. It is a finished product, ready for use as shipped, and its installation is less dependent on weather conditions than other materials.

U·S·S Steel Sheet Piling forms a continuous wall of rugged, interlocked steel sections—an invaluable construction medium for dams and dikes, in wharves, slips, seawalls, bridge pier retaining walls and railroad and highway abutments. Our engineers will be glad to discuss its possibilities with you.



THIS CONSTRUCTION VIEW of the Gordon Park Seawall shows how cells are joined by fabricated "Y" sections of U·S·S Steel Sheet Piling. Cells are basically MP101 sections.

UNITED STATES STEEL COMPANY, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

U·S·S STEEL SHEET PILING

2-486

UNITED STATES STEEL

STANG BONE-DRIES 1270' TRENCH

Heavy rains increased the ground water hazard in the excavation of a 1270 trench 17' below ground water level for the Norton Siphon on the Mohawk Canal, Gila Project, near Yuma, Arizona. In spite of these conditions, the 96" I.D. concrete pipe was lowered into a bone-dry trench in record time, at low cost, by using Stang Wellpoints. This is one more instance of the important part that Stang Wellpoints are taking in the excavation of irrigation canals and other sub-ground water level projects all over the United States.

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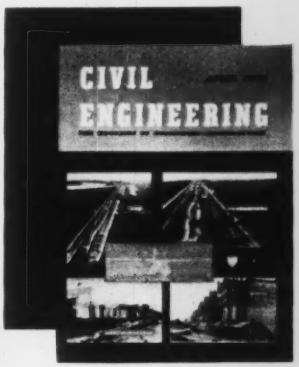

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ABP ABC

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EQUIPMENT, MATERIALS and METHODS

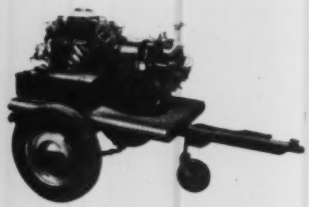
NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Tankdozers

TANKDOZERS to fit into the Armed Forces high speed tractor and tank program have just been announced. The tankdozers are being built at the Mattoon, Illinois plant of Gar Wood Industries, one of the largest integrated plants in the world devoted exclusively to the production of heavy duty scrapers, dozers and other allied tractor equipment. Models can be made available for every type of tank and high speed military tractor. Circulars describing the tankdozer are available as a guide and ready reference for those individuals responsible for procuring field equipment for the Armed Forces. **Gar Wood Industries, Wayne, Mich.**

Portable Air Compressors

A READY SUPPLY of compressed air can be had anywhere with the introduction of a line of portable air compressors. The compressors are mounted on a trailer with a standard trailer hitch for towing behind a car or truck. They also can be obtained with skid mountings where great mobility is not required or mounting in a truck body is desired. The compressors are manufactured in three sizes to deliver 21, 35 or 50 cu ft of air per min. In designing the

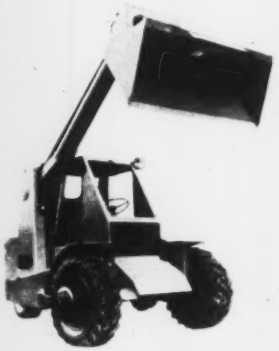


Available in Three Sizes

portable units, DeVilbiss engineers have used the V type, 4 cylinder, 2 stage compressors to assure long periods of dependable, continuous operation. Among the outstanding features are trouble free valves, a forged steel crankshaft, balanced and precision ground ball type main bearings and automotive insert type rod bearings. Cooling is accomplished through finned heads, cylinders and inter and after coolers. The compressors are driven by heavy duty, industrial type gasoline engines which are air cooled. The engines are available with either electric or magnetic engine starting systems. The 35 and 50 CFM compressors are equipped with governors to automatically slow down the engine while the compressor is unloading. **DeVilbiss Company, 296 Phillips Ave., Toledo 1, Ohio.**

Front-End Loader

INTRODUCTION OF the all hydraulic Scoopmobile, Model H, has been announced. The Model H comes equipped with $\frac{3}{4}$ yd scoop, has a rated lift capacity of 4000 lbs, the standard discharge height 8 ft. Vickers hydraulic steering, combined with Mixermobile planetary drive, provides the maneuverability and the power



Model H

to make the Model H a versatile and efficient front end loader. The Scoopmobile has numerous uses as a handler of bulk materials such as coal, fertilizer, sand and gravel, etc. It is used, also, for leveling and backfilling. With its attachments many uses can be found for handling bulk materials in industry. An efficient operator can handle up to 120 yds of bulk material per hour with the Model H. The operator has full vision from a safe, completely enclosed cab. Attachments include: swivel type concrete hopper, lift forks, special fertilizer or hay fork, and crane boom. **Mixermobile Manufacturers, 8027 N.E. Killingsworth St., Portland, Ore.**

Steel Measuring Tape

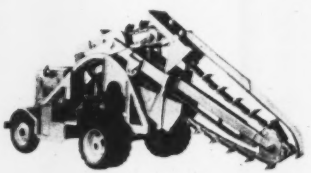
A STEEL MEASURING tape called Boss Wyteface, includes among its features a wide sweeping reel like winding handle with less friction and notched finger grips, convenient for working in all weather conditions, around the edge of a sturdy all-metal case. The measuring tape has the same well known Wyteface tape line characteristics, namely, black markings on a white background with the foot markings in red. **Keuffel & Esser Co., 300 Adams St., Hoboken, N. J.**

Hand Calculator

THE CURTA PORTABLE calculator fulfills a long felt need of men who work with figures or formulae. Precision made by Swiss watchmakers, the Curta calculator will add, subtract, multiply, divide, figure square roots, factors, cubes and percentages, and is as easy to operate as a slide rule. Amazingly accurate, the device carries to five decimal places and totals to 99 billion. Figures can be checked and rechecked on 3 sets of dials. **Curta Calculator Company, 5543 South Ashland Ave., Chicago, Ill.**

Rubber Tired Trenchliner

A HIGHLY MOBILE, rubber tired, ladder type Trenchliner that will handle all types of utility excavations has been announced. The Model 88 Trenchmobile digs to a maximum depth of 5 ft and widths of 8 or 12 in. Compact and highly maneuverable, the Model 88 has unlimited applications for digging trenches for utility mains and services and many other excavations within its range of widths and depths. Powered by a 43.6 hp gasoline engine, the Trenchmobile is a heavy duty unit constructed on an all welded arch type frame.



Model 88

Variable speed selections are provided for operating the bucket line, conveyor belt, travel and digging traction. Highly mobile, the 88 has road speeds up to 12.65 mph for self powered moves between jobs. Pneumatic tire mounting plus low ground pressure permits working and traveling over sidewalks, driveways and lawns without surface damage. In addition, these features are incorporated in the Model 88: controlled discharge through a reversible and shiftable belt conveyor; telescopic ladder type boom with positive down crowd; a hinged crumber that permits vertical set-ins and undercutting; self cleaning buckets fitted with easily replaced Tap-In teeth; automotive steering and rear wheel hydraulic brakes; antifriction bearing mounted main shafts with fully enclosed gears running in oil; optional blade for backfilling. **Parsons Company, Newton, Iowa**

Crawler Crane

A ¾ YD CRAWLER crane, available with a choice of fronts—crane, shovel, dragline or pull shovel, is announced. The Model 375 BC, as the unit is called, follows the same basic "American design" used in the huge 80 ton capacity locomotive crane and 100 ton revolving crane in that the machinery platform is an integral rolled steel electrically welded unit, rather than the conventional cast center with bolted on walkways. It definitely falls in the heavy duty 45,000 lb class. Track pads are double walled, special steel castings with full length pins. The steel used is a special development that reduces abrasive wear to a minimum, yet withstands the shock and strain of rough travel without breakage. Of special significance is a high speed boom hoist with controlled lowering arrangement which is standard equipment. Boom radius may be changed with perfect control and without danger of dropping the boom. The maximum lowering speed is the same as maximum raising speed, assuring absolute safety. The machine incorporates many features that insure operator comfort, ease of control and safety. **American Hoist and Derrick Company, St. Paul 1, Minn.**

Model 375 BC

Resins

THE PROPERTIES of two resins, Permutit S-1 and S-2, have been outlined in new data sheets. These resins are highly basic anion exchangers which are capable of removing silica from water in the ion exchange demineralizing process. This removal of silica is very complete—down to a fraction of 1 ppm. Permutit S-1 is especially resistant to reduction in basicity and capacity for silica removal when operated for a long period of time on many waters. Permutit S-2 has a higher capacity and greater regeneration efficiency than Permutit S-1 but is not quite as strong a base as Permutit S-1. Regeneration of these resins is accomplished with a solution of sodium hydroxide which removes the silica from the exchanger and restores its activity. **Permutit Company, 330 West 42nd St., New York 36, N. Y.**

CEMENT GUN COMPANY RESTORES CAUSEWAY WITH "GUNITE"

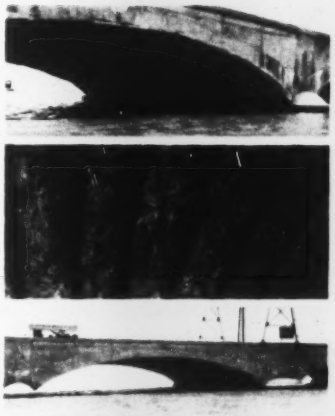


Photo at top illustrates the advanced stage of disintegration which ruined the underside of the arch and spandrels of a Texas Causeway. Cement Gun Company crewmen removed crumbling concrete and anchored reinforcing mesh in place. "GUNITE," sprayed on the concave arch, not only repaired the damage but also strengthened the Causeway and added to its original beauty.

This Causeway is typical of many types of structures we have reintegrated with "GUNITE." We have also illustrated and described many others for you in our 64-page Bulletin A2400. We'll be glad to send you a free copy at your request. Perhaps we can help solve some of your repair problems.

CEMENT GUN COMPANY
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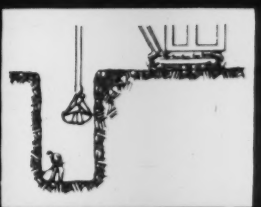

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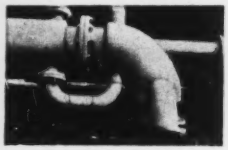

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Puyjalon River crossing abutment supporting plate girder railroad bridge. Cylinders were battered 1:6 both longitudinally and transversally with bridge.

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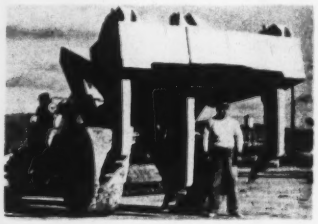
Equipment, Materials & Methods (Continued)

Heavy Duty Ripper

A 15-TON, HEAVY duty ripper, capable of penetrating 60 in. in extremely tough material, is now being made. The ripper is the culmination of nearly 20 years of development work and study of ripping requirements. It will take the combined drawbar



Designed for Rock Removal

pull of six of the largest tractors now on the market or 180,000 lbs on the center tooth alone. It will rip any laminated or foliated material, such as shale, decomposed granite, etc. The center is designed for three depths of penetration—60 in., 48 in., and 36 in.; the outside teeth for two depths—48 in. and 36 in. The ripper has a wide range of application and in many cases will take the place of explosives for shattering material to be handled by scrapers or shovels. **Peterson Tractor & Equipment Co., San Leandro, Calif.**

Lead Lubricant

A HEAVY DUTY grease lubricant known as Lead-Lube, made possible through advances in the field of powdered metallurgy and by homogenizing process, was announced. The significant factor in this lubricant is its extremely high metallic lead content in the form of a pulverized lead dust, kept in permanent suspension by the Knapp Process. Lead has long been regarded as the finest of lubricants, but its use in metallic form has been prevented by the lack of a successful method to keep it from settling out of suspension. Because Lead-Lube is a homogeneous blend, it represents a definite forward step in the lubricating field. The function of the metallic lead in Lead-Lube is to form self-lubricating surfaces over all the wearing parts of gears and bearings, so that the actual surfaces will be protected from wear. In the case of older equipment, the metallic lead will resurface pits and scores, and thus restore a degree of efficiency comparable to that which existed before wear. In addition to wear, gears and bearings are frequently exposed to corrosion which is due to water, moisture or corrosive chemicals. Five years of practical tests have demonstrated that the lead surfaces formed by applications of Lead-Lube will materially increase the life of machinery under these severe conditions. **Knapp Mills, Inc., 125 Broad St., New York 4, N. Y.**

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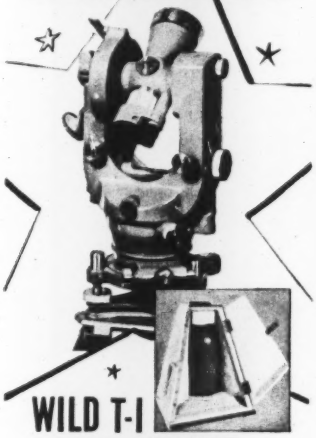

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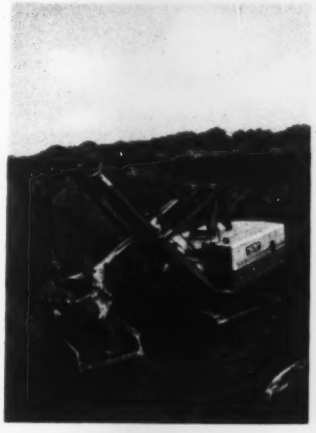
Equipment, Materials & Methods (Continued)

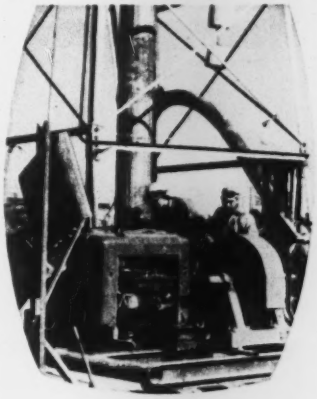
Excavator

A 6cu yd Ward-Leonard electric excavator, known as the Model 150-B, is announced. The shovel has a lower boom section rigidly connected to the A frame. It is an integral part of the machine. Widespread boom feet eliminate sway braces. The upper boom section is pin-connected to the lower boom section and is suspended from the A frame by fixed length bridge strands. The dipper handle is tubular and free to rotate in a cylindrical saddle block which contains rubber cushions to absorb shock loads during plugging of the swing. Single-part doubled hoist ropes are attached with an equalizing sheave to each side of the dipper. The conventional dipper bail is not used. Crowd and retract are accomplished by twin ropes, and the crowd machinery is located at the forward end of the revolving frame instead of on the boom. This reduces swing inertia as compared to older designs. The tubular handle free to rotate, and the rope crowd and retract contribute to low front-end maintenance. The dual twin hoist, an exclusive feature, automatically applies hoisting effort where needed on the dipper lip and teeth to cut through local obstructions in the bank. The dipper moves upward steadily in its digging stroke rather than detouring obstructions. The relatively light weight of the tubular handle and a favorable relationship between hoist and crowding power give a maximum of available digging effort to the shovel dipper. The shovel is fully convertible to a dragline, with the drag and hoist functions operated by independent electric motors. The difficulties of field conversion have been reduced to a minimum. Bucyrus-Erie Co., South Milwaukee, Wis.



Model 150-B

"Making Hole"
is just part of our job



To the well driller "Making Hole" means that everything is running smoothly and the hole is getting deeper and deeper. But to Layne, "Making Hole" is just part of building a fine well water supply.

Before a single rig is placed, Layne has used a lot of know-how planning, plotting and figuring out such things as; what size casing and what depth it is to be set, what kind and how much sand screen to use, what kind and size shafting to use and how much horse power the motors should have to produce the stipulated amount of water against a certain indicated pressure. Once all of these answers are on paper, they must be transmitted into an underground construction project;—a task that requires a lot of skill and ability.

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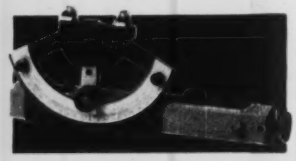

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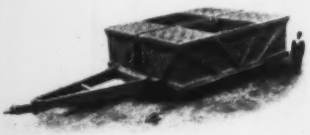
Equipment, Materials & Methods (Continued)

Compactor

A 200 ton rubber tired roller is announced. The unit was designed and built for use in testing fills on air base runways, particularly where XB52 jet bombers and other heavy planes are to operate; also for other fills where extreme compaction is necessary. The roller is designed in two halves, each half being provided with two tires and so arranged that each half will



Rubber Tired Roller

oscillate independently, thus following the undulation of the fill exactly. The unit is equipped with 4 - 30.00 × 33 in. - 40 ply, 150 lbs. psi Goodyear tires, each tire designed to carry a load of 100,000 lb. Specially built wheels are equipped with Timken bearings and grease seals. A special feature is the arrangement whereby wheel assemblies may, when necessary, be removed through the top of roller frame, thus facilitating tire repairs, etc. The rear of the roller is equipped with an extra tongue, so that propelling tractors may be used both front and rear if necessary. At the rear of roller is also furnished 15 hp, 4 cylinder, gasoline engine driving hydraulic pump which supplies 5000 lb. psi for 10 in. hydraulic cylinder. Piston is provided with various size pads or feet to test bearing capacity of fill. Also furnished is special bridge with fulcrum arrangement acting directly on special micrometer indicator gauge which records vertical displacement. **Shovel Supply Company** Box 1369, Zone 1, Dallas, Tex.

Gravel Plant

An addition to the 880 Gravelmaster series portable crushing, screening and loading plants is announced. The 880 Senior "R" incorporates new engineering developments to increase capacity yet keep traveling weight within State Highway limitations. The plant features a 10 in. by 36 in. roller bearing jaw crusher, 30 in. diameter by 22 in. face six gear roller bearing roll crusher, and a 4 ft. by 10 ft., 2-deck inclined gyrating screen. The plant is driven by a single 115-125 hp power unit mounted on the plant, or by a separate side drive through a universal joint connection from separate truck mounted power. The 880 Senior "R" can be fed by shovel, truck, or dragline direct from pit to hopper or with optional 180 deg swivel feed conveyor. **Universal Engineering Corp., Div. of Pettibone Mulliken Corp., Cedar Rapids, Iowa**

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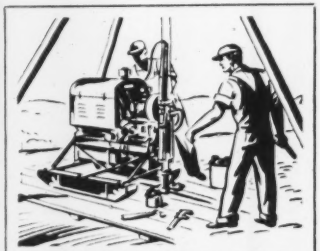

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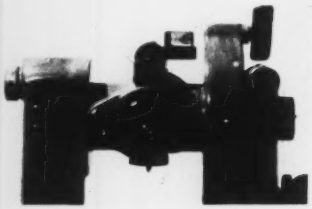
Equipment, Materials & Methods (Continued)

Prismatic Telescope Level

A VERY ACCURATE and fast working telescope level is now available as accessory for the T-1 optical transit. It has a sensitivity of 20 in. per 2 mm and is observed through the Wild prism system.



Accessory for T-1 Optical Transit

The bubble ends appear at convenient eye height and coincidence is established to 1 in. accuracy by means of the vertical tangent screw. With this accessory, the T-1 transit may be used for leveling jobs of high accuracy, including sewage and bridge work. **Henry Wild Surveying Instruments Supply Co., 26 Court St., Brooklyn 2, N.Y.**

Steel Shore

A SELF-CONTAINED, telescoping steel shore that is handled by one man and permits micro adjustment is announced. The product can be used effectively in supporting forms for concrete slabs, beams, columns, walls, tunnels and other shoring work. The shores permit a 5 ft range of adjustment. Only three sizes cover a range all the way from 6 ft to 15½ ft above the mounting surface. Heavier load-carrying capacities to as high as 9,900 lbs, with adequate safety factor, are made possible by the special sleeve nut design. As a result, spacing of the shores can be greater, reducing the number of shores needed and proportionately reducing erection and dismantling costs. Easier handling, economy and reduced maintenance result from other design advantages of the new equipment. No jacking devices or other separate accessories are required. The U-shaped head plate is designed for locating 4 in. lumber or lapped 2 in. lumber on edge. No nailing is required under normal conditions, but staggered nail holes are provided for use when desired. Safway equipment can also be used to eliminate close decking for shoring at heights greater than the maximum shore extension (11 ft, 13 ft, and 15½ ft in the three sizes available). The base plate of shores is quickly bolted to an adapter which can be mounted on the tubular legs of Safway frame-type scaffolding. **Sales Department, Safway Steel Products, Inc., 6234 West State St., Milwaukee 13, Wis.**

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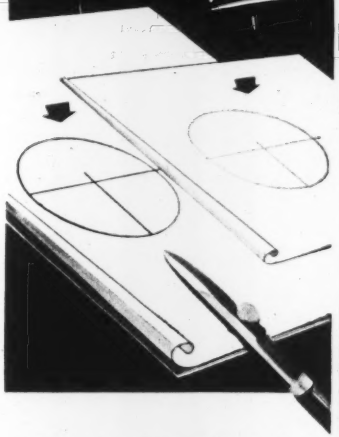

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Equipment, Materials & Methods (Continued)

Earth Mover

COMMERCIAL MODELS of the 2C500 Heiliner are now available. The unit is equipped with a 13 cu yd scraper. It is practical not only for contractors, but also for city, county, and state highway departments, utilities, and other operators of

2C500 Heiliner

such equipment for maintenance, stockpiling, and other purposes. Features include Heil's exclusive Hydro-Steer, unobstructed visibility, big, safe, heavy-duty 2-shoe air brakes synchronized on both the tractor wheels and the trailing unit wheels, and speeds up to 25 mph, even when loaded. A 165 hp Model HRB6000 Cummins diesel engine powers the 500 Heiliner. The larger 2C800 Heiliner, with its 200 hp Cummins diesel engine, 18 cu yd scraper, and 20 cu yd dump wagon fills out the line of Heil's high speed earth movers. **The Heil Company, Milwaukee 1, Wis.**

Rolling Door

A FULL VISION window for use in rolling steel doors, is now being produced. For many years there has been a demand for some type of window opening in the rolling door. Because this type of door is constructed of interlocking slat sections approximately 4 in. wide, openings in the past have been limited to slots within the width of the individual slat section. The full vision window can be furnished 12, 16, 20 or 24 in. in height and 20 in. in width. Two or more can be used in larger doors. The window is presently furnished with transparent aeroplane plastic lights, which are shaped and assembled to coil with the door. The full vision window permits a clear unobstructed view of exterior or interior, admits light, aids in controlling truck movement and keeping out intruders. A full vision window, because of its unique construction, preserves a solid closure when the door is closed, keeping out drafts, weather, etc., and coils up overhead with the slat curtain when the door is opened. **Cornell Iron Works, Inc., 36 Ave. & 13th St., Long Island City, N. Y.**

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Literature Available

FLOORS. A 12 page practical guide for economical and efficient care of floors in office buildings, institutions, factories, schools and colleges covers the conditioning, repairing and maintenance methods for the widest variety of floor materials—concrete, asphalt tile, cork, linoleum, magnesite, terrazzo, wood. **A. C. Horn Company, Inc., 10th St. & 44th Ave., Long Island City 1, N. Y.**

ELEVATING AND CONVEYING EQUIPMENT. A bulletin for the Cement and Rock Products Industries featuring Rex elevating, conveying and power transmission equipment has just been published. The book contains much useful information on drive and conveying chains and bulk handling equipment for the industry. Complete details and specifications of all chains used are given. Cutaway and diagramatic views of chain clearly show points of importance to observe in specifying equipment of this type. Ask for Bulletin 52-53. **Chain Belt Company, Dept. PR, Milwaukee 1, Wis.**

DEAERATOR. A 4 page bulletin, No. 3077, describing the Permutit Deaerator with internal direct-contact vent condenser has been prepared. Many advantages of this unit, which heats and deaerates water in three stages, are outlined in this bulletin. **The Permutit Company, Advertising Department, 330 West 42nd St., New York 36, N. Y.**

AIRPORT LIGHTING. An 18 page booklet on airport lighting equipment selection and electrical requirements is now available. In addition to a general description of the product, information is supplied on where the particular equipment may be best applied and what, if any, accessory apparatus is essential to its operation. Photographs are presented of each piece of equipment referred to in the wiring diagrams and the CAA equipment and installation specifications are stated. Ask for Booklet B-5428. **Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa.**

4-ROPE BUCKETS. A 44 page bulletin, No. 2392, will be of interest to users of overhead or bridge type cranes with 4-rope bucket trolleys. One of the features is a list of ten vital items for guidance of a prospective purchaser of a 4-rope bucket. There are numerous illustrations of bulk material handling including coal, ores, chemicals, etc., with performance data and comparisons of cargo dispatch and discharging vessels, barges and railroad cars. Helpful information and diagrams are presented on 4-rope bucket types, reeving, arrangement of cables for various types of cranes, cable life as influenced by sheave diameter, and how to determine the increase in payload through use of anti-friction bearings in bucket sheaves. **Bucket Department, Blaw-Knox Div., Pittsburgh 30, Pa.**

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Literature Available (Continued)

STEEL FOUNDRY PRODUCTS—The booklet, "The Steel Castings Industry—Build With Steel Castings," is designed to acquaint you and members of your organization with the products of the steel foundry. It contains a chart entitled "General Engineering Types of Steel Castings" which has been found useful as a guide to design engineers and others in determining the proper steel casting specifications. **Steel Founders' Society of America, 920 Midland Building, Cleveland 15, Ohio**

HOIST & BODY LINES—A colorful, illustrated and detailed bulletin on the Model 727, 827, 1027 and 1034 hydraulic hoists and their series 200 and 300 bodies has been prepared. These hoists and bodies are for use with heavy duty trucks. **The Perfection Steel Body Company, Galion, Ohio**

ELEVATING TOWER CATALOG—A comprehensive catalog offers complete data on single well and double-well models of the company's elevating towers. Specifications are clearly defined and rigging diagrams are illustrated for practical applications of this material handling equipment. The catalog also illustrates and describes all components required for erection of the towers having either 3,000 lb or 5,000 lb live load capacity. Ask for Catalog 249. **American-Tubular Elevator Company, Zelienople, Pa.**

GEAR MOTOR BOOKLET—An 8-page, two color bulletin on fractional horsepower gear motors listing 61 standard models from which to choose has been announced as available. Designated as GEA-5678, the publication describes the applications for FHP gear motors and outlines a simple method of determining correct horsepower requirements with the use of an ordinary pipe wrench and fish scale. The bulletin contains descriptions, cut-away drawings, selection charts, and dimension tables for both concentric shaft and right angle shaft gear motors, includes a section on maintenance pointers, and a complete list of G-E apparatus service shops throughout the country. **General Electric Company, Schenectady 5, N.Y.**

DIESEL TRACTORS—A 32-page booklet, Form 30182, "Attachments Increase Profits," shows many possibilities of adapting Caterpillar diesel tractors to specific jobs. The fully-indexed catalog explains uses and construction of each tractor attachment. Thirty action pictures supplement the catalog views. Specifications, drawings and dimensions are provided where needed. Included are such practical and low-cost items as cab heaters, rain traps and air prescreeners. Sizes of the attachments range upward to the steel cabs available with four models of tractors. **Caterpillar Tractor Co., Peoria 8, Ill.**

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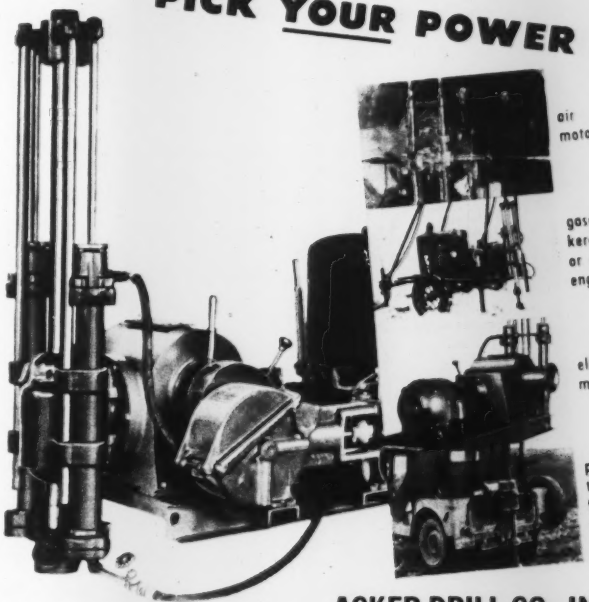

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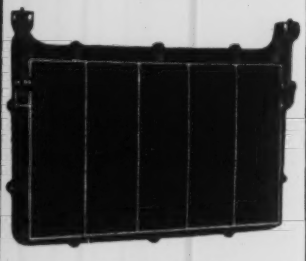

Fig. B-61. Type M-M

Type M-M (Rectangular) Tide Gates are available in 37 sizes from 8" x 8" to 96" x 96". Bulletin No. 71 describes them fully.

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Literature Available (Continued)

GENERATORS—A 4-page bulletin on the company's general line of products is offered. Generators AC, motor generators, converters DC to AC and power plants AC DC are presented together with photographs, specifications and informative data. **Kato Engineering Company, Mankato, Minn.**

LONG HOLE DRILLING—A 4-page bulletin fully covers the recommended procedure for drilling long holes varying in depth from 20 to 150 ft with tungsten carbide Rok Bits, long hole drilling tools and the standard percussion type drills. Such holes can be drilled in any type rock or ore in any direction, in two standard dimensions 1⅞ in. and 3 in. **Rock Bit Sales and Service Co., 2514 East Cumberland St., Philadelphia 25, Pa.**

THREE MACHINES IN ONE—A 4-page, two color bulletin on the Model 80 backfiller, tamper, side crane has been published. The versatile, one-man operated machine backfills as it tamps as it travels. The folder uses text as well as action photographs to good advantage in depicting and describing the varied operations performed by the 80. Complete specifications and dimension data are clearly presented. Request Form S120. **Cleveland Trencher Company, 20100 St. Clair Ave., Cleveland 17, Ohio**

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PROCEEDINGS AVAILABLE

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Summarized in Earlier Issues

D-54. Discussion of Paper, **Truss Deflections by the Coordinate Method,** by Kuang-Han Chu. In Proceedings-Separate No. 54.

D-61. Discussion of Paper, **Structural Damping in Suspension Bridges,** by the late Friedrich Bleich and L. W. Teller.

112. **Diversions from Alluvial Streams,** by C. P. Lindner.

113. **Wave Forces on Breakwaters,** by Robert Y. Hudson.

114. **Utilization of Underground Storage Reservoirs,** by Harvey O. Banks.

D-51. Discussion of Paper, **Laterally Loaded Plane Structures and Structures Curved in Space,** by Frank Baron and James P. Michalos.

D-57. Discussion of Paper, **Design of Irrigation Systems,** by W. H. Nalder.

D-60. Discussion of Paper, **Surveying and Mapping Requirements for Modern City Planning,** by Charles A. Blessing.

D-62. Discussion of Paper, **The New Towns Program in Great Britain,** by T. C. Coote.

115. **Lake Michigan Erosion Studies,** by John R. Hardin and William H. Booth, Jr.

116. **Graphical Solution of Hydraulic Problems,** by Kenneth E. Sorensen.

117. **Development of Stresses in Shasta Dam,** by Jerome M. Raphael.

118. **Flocculation Phenomena in Turbid Water Clarification,** by Harvey F. Ludwig, W. F. Langelier, and Russel G. Ludwig.

D-56. Discussion of paper, **Turbulent Transfer Mechanism and Suspended Sediment in Closed Channels,** by Hassan M. Ismail.

D-70. Discussion of **Regime Theory for Self-Formed Sediment-Bearing Channels,** by T. Blench.

Third Notice

119. **Thin-Walled Members in Combined Torsion and Flexures,** by Warner Lansing.

120. **Surface Water Wave Theories,** by Martin A. Mason.

121. **Rate of Change of Grade per Station,** by Clarence J. Brownell.

122. **Engineering Aspects of Diffraction and Refraction,** by J. W. Johnson.

D-59. Discussion of Paper, **Limit Design of Beams and Frames,** by H. J. Greenberg and W. Prager.

D-65. Discussion of paper, **National Topographic Mapping,** by W. E. Wrather.

D-71. Discussion of Paper, **Rectification of the Papaloapan River in Mexico,** by Reynaldo Schega.

Second Notice

123. **Long-Period Waves or Surges in Harbors,** by John H. Carr. This paper reports the results of field and model studies of the sources and characteristics of long-period waves in harbors and analyzes the subjects of basin resonance and water motion induced by the waves. The particular adaptability of models to this type of study is discussed, and examples of the use of models in the design of harbor facilities are given. (Available May 1.)

124. **Influence Lines by Corrections to an Assumed Shape,** by James P. Michalos and Edward N. Wilson. This is a procedure for obtaining influence lines for continuous structures directly from a consideration of geometry. It is applicable to structures of constant or variable section, whether or not subjected to joint translation. Since it is a numerical method involving successive corrections to an assumed shape, the procedure lends itself to precise analytical computations, design studies and development of judgment and sense of scale. (Available May 1.)

125. **Torsion of Plate Girders,** by F. K. Chang and Bruce G. Johnston. Analytical and experimental research was undertaken at Lehigh University, Bethlehem, Pa., to determine the stress distribution stiffness, and strength of bolted, riveted, and welded plate girders under uniform twisting moment.

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Formulas are proposed for calculating rivet or bolt pitch and size of welds for the bolted, riveted and welded plate girders. When rivet pitch or weld size is given, the torsional stiffness and strength can be predicted. (Available May 1.)

126. **Variation of Wind Velocity and Gusts with Height**, by R. H. Sherlock. The flow of air in level, open country is adopted as the standard of reference in this paper, assuming that the influence of local shielding and unusual topography will be evaluated by the designer in each individual case, perhaps with suggestions in the code. Recommendations are based on velocity pressures rather than on design pressures. (Available May 1.)

D-53. Discussion of Paper, **Wedge-Beam Framing**, by Arsham Amirikian. In the original paper, published in January 1951, suggested arrangements of wedge beam framing are outlined. The range of application is discussed, and a method of analysis is presented. Formulas and tables, as well as a simplified procedure for solution of simultaneous equations, are also given to facilitate the necessary computations in practice. Discussers are: C. C. Ernst, J. J. Hromadik, C. R. Swihart, Herbert A. Sawyer, Jr., J. J. Polivka and Arsham Amirikian. (Available May 1.)

D-72. Discussion of Paper, **Design of Large Coal Bunkers**, by Paul Rogers. The original paper, published in June 1951, attempts to present a rational design procedure based upon several coal bunkers actually constructed. Formulas for coal pressures on vertical and inclined walls are reviewed and values are tabulated. Bunker walls are presented as flexible plates; unbalanced forces due to asymmetry are analysed; and continuity for the stiffeners is introduced. Discussers are: George L. Blanchard, Alexander M. Turitzin and Paul Rogers. (Available May 1.)

First Notice

127. **Stresses in Deep Beams**, by L. J. Chow, Harry D. Conway, and George Winter. Beams whose depths are comparable to their spans are used in a variety of structures. Information for single-span beams is presented in this paper. Five cases of loading are studied and for four of these cases, three different span-to-depth ratios are examined. Distribution and magnitude of bending and shear stresses are given in graphical and tabular form suitable for direct use in design. Although this information is applicable to structures made of homogeneous material, their use in connection with reinforced concrete requires some special considerations that are briefly outlined. (Available June 1.)

128. **Horizontally Curved Box Beams**, by Charles E. Cutts. A beam curved horizontally through an angle of 90° and resting on four supports is analyzed for maximum torque, shear, moment deflection and rotation when the beam carries a uniform load. Three types of curved box beams were fabricated and tested with five concentrated loads placed symmetrically on the curved part of the beam to assimilate uniform loading. Unit strains were measured at critical points on the beam by means of SR-4 electrical strain gages. A new method of design for closed section curved beams and a theoretical development for determining rotation and longitudinal warping stresses are included. (Available June 1.)

129. **Analysis of Arch Dams of Variable Thickness**, by W. A. Perkins. It is always desirable to build an arch thicker at the abutments than at the crown in order to secure the most economical design. Heretofore, however, the determination of stresses in such a structure has been extremely laborious, but with the aid of the formulas and curves presented in this paper, the stresses can be determined by slide rule in a very short time. Furthermore, practical use of the formulas and curves does not require a thorough comprehension of the mathematics involved in the development. (Available June 1.)

130. **Underground Corrosion of Piping**, by R. V. Brannon. This discussion of the subject of underground corrosion of piping is based on the writer's experience in the industry of transporting liquid petroleum by pipelines, and his association with others in this industry and the related industry of transporting petroleum gas by pipelines. Although the underground piping systems with which members of the ASCE are concerned may differ in many respects from those in the oil and gas industries, it is likely that many of the corrosion problems are common to all of them. This paper is limited to the outside metal piping buried in soil. (Available June 1.)

131. **The Allegheny Conference Planning in Action**, by Park H. Martin. Since 1943 the Allegheny Conference on Community Development has been developing and backing a plan of municipal improvement for the greater Pittsburgh, Pa., area. Among the many civic improvements credited to the Conference are a successful smoke-abatement program, highway and bridge development, planning for stream-pollution abatement, and alleviation of parking congestion in the city. (Available June 1.)

132. **Specifications for Structures of a Moderate Strength Aluminum Alloy of High Resistance to Corrosion, Progress Report of the Committee of the Structural Division on Design in Lightweight Structural Alloys.** The specifications cover allowable stresses, design rules, and fabricating procedures for structures built of aluminum alloy known commercially as 61S-T6. (Available June 1.)

D-66. Discussion of Paper, **Lateral Forces of Earthquakes and Wind**, by a Joint Committee of the San Francisco Section of ASCE and the Structural Engineers Association of Northern California. The original paper, published in April 1950, developed a dynamic criterion for design of lateral earthquake and wind forces and a provision for building codes based on this criterion. Discussers are: Seismic Research Group; Reuben W. Binder, R. R. Martel, G. W. Housner and J. L. Alford; S. K. Guha and Gurdas Ram; and a Joint Committee of the San Francisco Section of ASCE and the Structural Engineers Association of Northern California. (Available June 1.)

D-79. Discussion of Paper, **Stage Predictions for Flood Control Operations**, by Ralph E. King. The original paper, published in July 1951, described the problems relative to the prediction of stages in the lower Mississippi River Valley during flood periods. Discussers are: Robert Büchler and W. S. Hoehl, and Ralph E. King. (Available June 1.)

D-80. Discussion of Paper, **Mississippi River Valley Geology Relation to River Regime**, by Harold N. Fisk. The original paper, published in July 1951, described the geology of the alluvial valley of the lower Mississippi River and major changes in stream activity. Discussers are: Leo M. Odom, Stafford C. Happ, and Harold N. Fisk. (Available June 1.)

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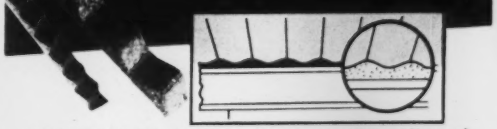

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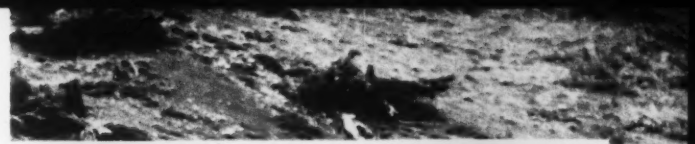

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